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ABSTRACT

This 535-page document includes more than 60 papers presented at the 20th Annual Conference of the Visual Literacy Association. Topics cover a wide range of visual literacy interests: computer generated graphics, message design, desktop publishing, photography, critical viewing skills, memory enhancement, and the development of visual communication courses. Many papers contain diagrams, illustrations, and references. (Author/GL)

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ABOUT VISUALS: RESEARCH, TEACHING AND APPLICATIONS

Editors: Braden, Beauchamp, Miller, Moore

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ABOUT VISUALS: RESEARCH, TEACHING AND APPLICATIONS

Readings From the 20th Annual Conference of the
International Visual Literacy Association

EDITED BY
ROBERTS A. BRADEN
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The Effect of Inductive and Deductive Instructional Strategies on Students' Ability to Profit from Visualized Instruction

Michael R. Akanbi & Francis M. Dwyer
The Pennsylvania State University

Introduction

This study focused the realization that all students do not profit equally from traditional learning environments. Because learning is "multidimensional" it is often necessary that multivariate analyses be utilized to investigate the interrelationships among variables which may influence increased learning. This study attempted to identify and examine the interrelationships which exist among instructional strategy (inductive/deductive), instructional visualization (present/absent), locus of control (internal/external) and the students' prior knowledge level (low, medium, high). The specific questions which guided the study were: (a) Will externally controlled students benefit more from an inductive or a deductive instructional strategy? (b) Can visualization enhance learning and thereby result in higher achievement when students are presented with inductive or deductive instructional strategies? and (c) Is it beneficial to group the students undertaking the same instructional sequence (inductive or deductive) on the basis of their level of focus of control or on their level of prior knowledge in the content area?

Literature Review

Hermann (1) in a review of the literature concluded that the deductive strategy was equally effective as the inductive or the discovery learning strategy in improving student achievement. Long (2) found insignificant differences between the inductive and deductive treatments in terms of knowledge of specifics; however, in knowledge of generalization the inductive group achieved significantly better than did the deductive group. A test administered one week later found that insignificant differences in achievement existed between the two groups. It was concluded that the significant difference which occurred in terms of generalization might be due to the fact that the students, taught by the inductive approach, were more likely to remember the generalizations they themselves formed. In separate studies Dwyer (3) and Arnold and Dwyer (4) examining the relationship between students entering behavior and visualized instruction found that regardless of presentation type or even type of visualization employed, students who possessed high levels of prior knowledge performed equivalently or better than those who possessed low and medium prior knowledge levels in a specific content area. Additionally, the inductive and deductively sequenced visuals were found not to be equally effective in facilitating student achievement of all types of educational objectives.

Locus of control has been defined as a form of self-appraisal related to the degree to which individuals view themselves as having some causal role in determining specific events. In general, internals are described as individuals who perceive their behavior as being directly related to outcomes; whereas externals perceive outcomes as being dictated by chance, luck, or circumstances outside of their control. The interactive effective of locus of control, student satisfaction, teaching strategy and student performance were studied by Parent et al. (5). The teaching strategy was classified as either high-disciplined or low-disciplined. The former involved high-teacher or machine-control over both transmission of information and conditions of learning in the classroom. The latter involved low degree of teacher control and a high degree of freedom for the student to select materials and his own learning experience. The work-load was found to be higher for the high-disciplined teaching strategy. This was said to be due to the rules imposed on the students who had to take notes and complete various quizzes. Internals and externals respectively performed better under low and high-disciplined teaching strategies. Johnson and Croft (6) found that course performance in personalized system of instruction (PSI) was unrelated to locus of control. Internals did not have faster rates of course completion but did not earn more points than the externals. Initial internal-external scores were not significantly correlated with the number of sessions needed to complete the course and the number of points earned. Furthermore, there was no significant difference found between the internals and externals in their utilization of student proctors. It was concluded that locus of control was unrelated to the indicators of performance in the PSI course.

The relationship between locus of control and method of instruction was studied by Daniels and Stevens (7). The traditional-teacher-controlled (TTC) and Contract-For-Grade (CFG) were the two methods of instruction used in the study. The achievement motivation was expected to be high for the internals and externals under CFG and TTC, respectively. In the CFG, the student set his own objectives, content and quantity of work for a specified grade. That is, rewards of work and effort were within the student's control. A disordinal interaction was found between method of instruction and locus of control. Internals and externals did better under CFG and TTC, respectively. A post-hoc analysis of the interaction of sex, locus of control and instructional method, revealed no significant sex difference. The influence of locus of control on academic achievement was investigated with respect to the inductive and deductive teaching methods (8). The inductive and deductive groups were given criterion measures consisting of subtest of lower-level questions, a subtest of higher level questions and a total test. Regression analysis showed an interaction between the locus of control and the instructional procedures for the criterion measure of the subtest composed of lower level understanding. The slopes of the regression lines were negative for inductive group and positive for the deductive group when the lower-level-question items were the criterion measure. Internally controlled subjects scores higher under the inductive treatment. On the lower level questions, the deductive treatment treatment was more effective than the inductive treatment. They concluded that there was a significant interaction between the locus of control and achievement under different instructional methods and level of subject matter.

Treatments

The content material employed in this study was a two thousand-word instructional unit describing the human heart, its parts, and the internal processes that occur during the systolic and diastolic phases. The unit was organized into nineteen sub-units and each unit was complemented by simple line drawings designed to illustrate specific information being presented in the print mode. Two basic instructional formats (inductive and deductive) were programmed into the microcomputer. Each format contained the same content and the same illustrations. The deductive treatment was linear and didatic (Figure 1, Plate 1), whereas the inductive treatment contained multi-branching, main-menu-bidirectional and self-adaptive opportunities (Figure 1, Plate 2). The deductive sequence was computer controlled and the inductive sequence was totally under the student's control. Two instructional formats were complemented with visual illustration of the heart thereby producing inductive-visualized, inductive-nonvisualized and similar deductive formats.

Specifically, the deductive sequence started with an introduction and description of the study along with directions to the student. Within the deductive sequence the student had the option to move forward or backward by one screen frame at any given time during the lesson. Upon completion of the lesson a review menu was displayed on the screen and students had the opportunity to review any information previously experienced (Figure 1, Plate 3). However, the student, in selecting one unit of review instruction, was required to go through all the later units after the one he selected. At the beginning of the inductive sequence the main menu was displayed on the screen and students were permitted to select whatever section they preferred. Starting instructions, operational directions and physiological units of the heart were possible options. Students receiving this format also had the option to move forward or backward by one screen frame; however, they were also able to return to the main menu at any time. The review menu was the same as that received by students in the deductive sequence, but it always provided options. For example, from each option students would exit to the main menu from which they could, at will, end the instruction. Figure 1, Plate 3 illustrates the instructional sequence options provided to students in the deductive and inductive sequences.

FIGURE 1 INSTRUCTIONAL SEQUENCES AND REVIEW MENU OPTIONS AVAILABLE WITHIN THE DEDUCTIVE AND INDUCTIVE FORMATS

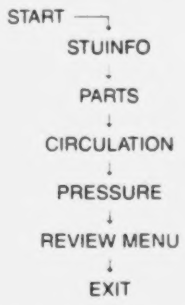

START
STUINFO
PARTS
CIRCULATION
PRESSURE
REVIEW MENU
EXIT

PLATE 1 THE DEDUCTIVE INSTRUCTIONAL SEQUENCE. LEGEND: STUINFO=information collected from the student. PARTS=Parts of the Heart. CIRCULATION=Circulation of Blood Through the Heart. PRESSURE=Cycle of Blood Pressure within the Heart

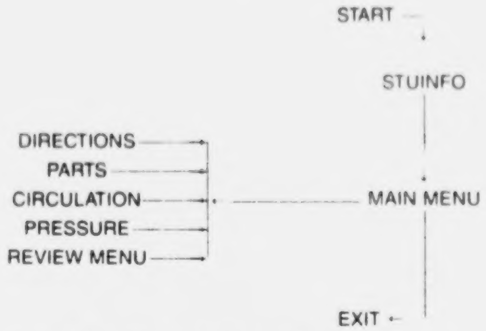

START
STUINFO
DIRECTIONS
PARTS
CIRCULATION
PRESSURE
REVIEW MENU
MAIN MENU
EXIT

PLATE 2 THE INDUCTIVE INSTRUCTIONAL SEQUENCE
(Multiple-Branching, Bidirectional Main-Menu)

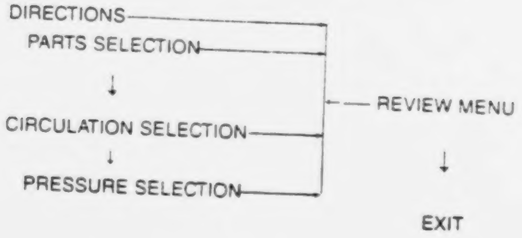
were fifty-five and 151, respectively. The age of the subjects ranged from eighteen to forty-nine. There were sixty-seven graduate and 139 undergraduate students in the study. The subjects were administered a pretest composed of thirty-six items constructed from human physiology (10, 11). The Rotter's Locus of Control Scale (Rotter, 1966) was then used to identify the subject's tendency towards either the internal or external locus of control orientation. This was followed by a self-paced computer-based inductive or deductive lesson on the physiology of the human heart. The same content was used for both the inductive and deductive lessons. While the inductive lesson had multiple-branching and self-adaptive mechanics, its deductive counterpart was linearly sequenced and resembled the traditional didactic instruction. The inductive and deductive lessons existed in both the visualized and nonvisualized versions. Each subject was given a comprehension test after studying the lessons.

Based on their scores on the locus of control scale students were divided into deductive and inductive treatment groups. Students were later divided on the basis of their scores on the Physiology Pretest into low, medium and high levels of prior knowledge. This categorization was based on division which was half a standard deviation unit above and below the mean on the physiology pretest score. Following is a list of treatments, distribution of students on each treatment and its identification abbreviation.

Inductive Instructional Strategy	(N=131)	IND
Deductive Instructional Strategy	(N=75)	DED
Presence of Visualization	(N=155)	VAP
Absence of Visualization	(N=51)	VAB
Internal Locus of Control	(N=103)	VINT
External Locus of Control	(N=103)	VEXT
High Prior Knowledge Students	(N=32)	HPKS
Medium Prior Knowledge Students	(N=137)	MPKS
Low Prior Knowledge Students	(N=37)	LPKS

The presence of the cited treatments enabled the following comparisons to be examined in the factoral design:

GROUP
1. (DED,VAP,VEXT,LPKS)
2. (DED,VAP,VEST,MPKS)
3. (DED,VAP,VINT,LPKS)
4. (DED,VAP,VINT,MPKS)
5. (IND,VAB,VEXT,HPKS)
6. (IND,VAB,VEXT,MPKS)
7. (IND,VAB,VINT,HPKS)
8. (IND,VAB,VINT,MPKS)
9. (IND,VAP,VEXT,MPKS)
10. (IND,VAP,VINT,MPKS)



Review Menu for the "Parts of the Heart"

- A. SEPTUM
- B. APEX
- C. RIGHT AURICLE
- D. LEFT AURICLE
- E. RIGHT VENTRICLE
- F. LEFT VENTRICLE
- G. PERICARDIUM
- H. EPICARDIUM
- I. MYOCARDIUM
- J. ENDOCARDIUM
- K. SUPERIOR VENA CAVA
- L. INFERIOR VENA CAVA
- M. TRICUSPID VALVE
- N. RIGHT VENTRICLE TENDONS
- O. PULMONARY ARTERY
- P. PULMONARY VALVE
- Q. PULMONARY VEINS
- R. MITRAL VALVE
- S. LEFT VENTRICLE
- T. AORTA
- U. AORTIC VALVE
- Z. Back to Review Menu

Review Menu for the "Circulation of Blood Through the Heart"

- A. PULMONARY VALVE
- B. AORTIC VALVE
- C. MITRAL VALVE
- D. TRICUSPID VALVE
- E. SUPERIOR VENA CAVA
- F. INFERIOR VENA CAVA
- G. PULMONARY VEINS
- H. AORTA
- I. SEMI-LUNAR VALVES
- J. PULMONARY ARTERY
- Z. Back to Review Menu

Review Menu for the "Cycle of Blood Prussure in the Heart"

- A. DIASTOLIC PHASE
- B. DIASTOLIC PRESSURE
- C. SYSTOLIC PHASE
- D. SYSTOLIC PRESSURE
- E. SEMI-LUNAR VALVES
- F. TRICUSPID VALVE
- G. MITRAL VALVE
- H. PULMONARY ARTERY
- I. AORTIC ARTERY
- Z. Back to the Review Menu

PLATE 3. THE GENERAL REVIEW MENU.

Criterion Measures

Rotter's (9) Internal-External Locus of Control Scale was used to identify the degree of externality among students participating in this study. The scale consists of twenty-nine forced-choice items, six of which are filter items. The 36-item Physiology Pretest (10, 11) was used to identify student's level of prior knowledge in the content area (low, medium, high). The comprehension test consisted of twenty multiple-choice items which measured whether students had acquired an understanding of the heart, its parts and its internal functioning during both the systolic and diastolic phases. The average KR-20 reliability for this test is in excess of .77 (10 p. 47).

Experimental Design

The effects of instructional strategy on student achievement were studied by utilizing 2x2x2x3 factoral design. The factors were instructional strategy (inductive, deductive), instructional visualization (present/absent), locus of control (internal/external) and students' level of prior knowledge (low, medium, high). Two hundred and six students at The Pennsylvania State University participated in the study. The number of male and female subjects

Results

The experimental design was analyzed for its main effects and interactions. Pretest and comprehension test scores were used separately as the dependent variables. With the pretest scores as the dependent variable, the design model was highly significant F(9,196) = 16.61, p. .01. At the hypothesized .05 level of significance, interactions were not significant. The Least Significance Difference test (LSD) indicated that the inductive and deductive instructional strategies were found to be significantly different at the .05 level of significance. Furthermore, the presence and absence of instructional visualization was found to be an important instructional variable as the .05 level. The internal and external tendencies of Locus of Control were not significantly different as the .05 level. However, the three prior knowledge levels were found to be significantly different as the .05 level. When the comprehension test scores ~~were used as the dependent~~ variable insignificant differences were found to exist among the instructional treatments (F(9,194, = 1.40, p. .19). Only the measure of Locus of Control, as a main effect, was found to be significant as the .05 level. At the hypothesized .05 level of significance; however, there were no significant interactions. The inductive and deductive instructional strategies were not significantly different and the presence and absence of instructional visualization was also found to be statistically insignificant.

In comparing the effects of instructional strategy with students' prior knowledge it was found that:

a. Visualized inductive and deductive instructional sequences are not equally effective in facilitating the achievement of students possessing different prior knowledge levels,

b. Regardless of instructional sequence, high prior knowledge level students achieved better than medium and low prior knowledge level students,

c. Visualization generally reduced achievement differences between students identified as being in the medium and low prior knowledge level students,

d. The visualized deductive instruction was most effective with low prior knowledge level students; whereas, the nonvisualized inductive instruction was most effective with the high prior knowledge level students,

e. The visualized inductive and deductive sequences were found to be equally effective with the medium prior-knowledge level students.

f. The direction of increasing dependence on instructional visualization was from the internally controlled, high prior knowledge level students who received a nonvisualized inductive instruction to the externally controlled, low knowledge level students who received the visualized deductive instruction.

Discussion

The locus of control variable did not have a significant main effect in facilitating student achievement in their ability to generalize and perform on the comprehension test. In general, the locus of control variable dichotomizes individuals who take responsibility for their own learning and those who do not. The insignificant achievement results obtained in this study may be partially explained by the fact that college students were used as the experimental population. Although they were divided into intervals and externals based on their performance in the Rotter I-E Scale, the dichotomy itself may have been artificial. Since most college students have already exhibited internal characteristics (being of the belief that industrious behavior-study will lead to success) the division merely separated internals into two groups called internals and externals. Under these circumstances it was unrealistic to expect significant differences to reveal themselves in terms of increased performance.

The finding of no overall main effect of instructional strategy (inductive, deductive) agreed with Hermann (1) who concluded that the deductive strategy was equally effective as the inductive strategy. However, the contentions of Breaux (12) indicate that the relative ineffectiveness of the presentation strategies might have been caused by the instruction generated by the delivery system--the computer-assisted format. This finding may be tempered somewhat by the fact that when the population samples in the inductive and deductive strategies (both visualized and nonvisualized) were further divided into high, medium, and low prior knowledge levels a number of interesting findings emerged. For example, it was found (a) each of the four treatments (deductive and inductive, both visualized and nonvisualized) were equally effective with students possessing medium prior knowledge levels in the content area, (b) the visualized deductive instructional strategy was most effective with the low prior knowledge level students and (c) the nonvisualized inductive strategy was found to be most effective with students possessing high prior knowledge of the content area. In general, students who possessed low prior knowledge benefited from the deductive visualized strategy which was highly structured, whereas, the high prior-knowledge students profited maximally from the internally controlled nonvisualized inductive strategy. Apparently the low prior knowledge level students benefited from the structure provided by the deductive strategy and the rehearsal provided by the visualization to acquire the basic orientation to the content necessary for them to advance to the generalization stage measured by the comprehension test. The high prior-knowledge level students already possessed sufficient prior knowledge in the content area so that they were not dependent on the visualization for their basic orientation. Additionally, since they were more knowledgeable to begin with, they were more likely to take advantage of the opportunities provided in the inductive strategy thereby enhancing their information acquisition.

Regardless of instructional strategy or presentation method employed, it was found that the high prior knowledge level students performed better than the low and medium prior knowledge level students. Additionally, it was found that the use of visualization has a tendency to reduce the individual achievement differences between the low and medium prior knowledge level students as measured by their performance on the comprehension test.

The findings of this study emphasize the importance of the interrelatedness of variables associated with learning and the effective use of visualization in the teaching-learning process. It verifies the fact the visualization in the instructional process functions not as an isolated phenomena, but as an interrelated constituent process operating at varying levels of complexity--the elements of which ~~acquire significance only in the context~~ in which they are used.

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Digitizing, Paint Programs and Visual Literacy

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Introduction

Several recent advances in computer technology have made professional quality capabilities available to the educational process. High-quality desktop publishing has made inroads into the classroom and the administrative office. Affordable professional quality recording studios are now available for moderate size school and even home use. This paper focuses on the implications for visual literacy of a less well-recognized, but equally significant technological advance: the availability and modifiability of high quality visual microcomputer images.

One reasonable approach to understanding visual literacy is to draw upon our knowledge of literacy in general. At an elementary level of literacy, writing and reading require the ability to encode and decode the meanings of written language. By analogy, drawing and seeing require the ability to encode and decode the meanings of visual images at this level of literacy. At higher levels of literacy, we may expect the creation of novel encodings and decodings of written or spoken language. Again by analogy, the recognition or creative production of visual images in an individual also signals a higher level of literacy.

Three recent developments in microcomputer technology combine to form exquisite tools for the development of visual literacy in the described sense. First, with the second generation of microcomputers came extended memory, sound and graphics capability capable of producing reasonably adequate visual microcomputer images. Second, a process called digitizing was developed which allows the user to import visual images into the microcomputer easily. Third, paint programs or paint systems are microcomputer programs which allow efficient and interesting creation and modification of visual images within the microcomputer.

Apparently, very few professional educators are concerning themselves with this matter. An ERIC search of the last five years using descriptors "visual literacy and computers", "creativity and computers" and "digitizing" produced only a handful of references, none of which were very recent. Other than Peterson's (1984) excellent presentation of the professional artistic use of computer tools, these references do not specifically discuss the problem at hand.

Therefore, it is the purpose of this paper to describe these recent developments and to discuss the implications of microcomputer digitizing and paint programs for the development of visual literacy.

Digitizing

The digitizer may be understood by analogy with the keyboard. Since the middle '70s, getting symbolic information into and out of the microcomputer has been straightforward. The keyboard has served as the major microcomputer input device, and the monitor and printer have served as the major microcomputer output devices for symbolic information. However, input devices for visual images have included or have been only slightly more adequate than the keyboard--paddles, touch tablets, joy sticks, and mice. Now, two new input devices are common--the digitizer and the scanner. Currently, the digitizer is by far the most adequate input device for generating microcomputer graphics that are realistic copies of color video input.

Actually, all the information that goes into the modern microcomputer must be "digitized" in the broad sense of being converted into a sequence of binary numbers--1's and 0's. This includes visual information. For every qualitative visual image consisting of patches of colors, there exists a unique encoding into a sequence of binary numbers. The color graphic image on the microcomputer screen results from a translation via electronic circuity of some particular configuration of binary numbers in an area of memory reserved for graphics. The digitizer reverses this process--it translates a color graphic image from some medium through electronic circuits into its unique encoding of 1's and 0's.

Digitizers are the best source of visual images currently available for microcomputers. They are remarkably flexible in the input they accept. The digitizing setup in our laboratory accepts input from videotape players, videodisc players, or television cameras. Coupled with the higher resolution of and greater variety of color in recent microcomputer images, digitizers can produce visual images which approach or even exceed the standard for television.

Another point about digitizing is significant for our discussion. Each microcomputer visual image is made up of pixels. The resolution of a graphics screen is reported in pixel dimensions. For example, a high resolution image may be 200 by 300 pixels. The light at each pixel is resolvable into five vectors. Three vectors represent the three primary colors: red, blue, and green. This is the way apparently irreducible qualitative color information concerning hue is quantified. Every hue may be represented as some specific proportion of red, blue and green. The other two vectors represent the brightness and saturation of the pixel. "Brightness" refers to the intensity of the hue, while "saturation" describes the amount of hue, as opposed to gray tone, contained in the color. The significance of these facts for our discussion is that the hue, brightness and saturation of digitized images are easily manipulated.

Software is included with digitizers which permits significant alteration of the digitized image. For example, one popular digitizer permits adjustment of the amount of red, green or blue in the image, as well as the amount of brightness or saturation. The practical result of this capability is that the image can be "fine tuned" to more closely resemble the source image. Interesting effects can be created by shrinking and expanding the images--several images can be combined, or a peculiar "chunking" effect can be achieved because of the loss of information in shrinking.

Paint Programs

Paint programs are the microcomputer analogue of painting tools in the domain of the arts. Peterson (1984) draws a further analogy:

> Much like a word-processing system, the paint system does not require sophisticated technical knowledge from its user. The artist still makes all aesthetic decisions--the paint system simply eases the dull and repetitive mechanics of creation." (p. 74)

One aim of painting is to create a visual image, hopefully, with aesthetic value. Paint programs allow the creation of visual images, both on the microcomputer screen and as output from printers. However, unlike traditional painting tools, paint programs give the user a tremendous sense of power and control over the process of creating a visual image with only a modest investment of time and energy.

These programs all contain a similar range of functions. In this paper we will discuss the following paint program capabilities: drawing tools, palette options, editing, and file management. In addition, one can typically add a variety of text to his or her drawings. Many of the drawing tools are analogues of the painting tools of traditional art: pencils of varying thickness, spray paint, and erasers. In addition, there are many drawing tools unique to the microcomputer. Palette options refer to color choices for painting, as well as the possibilities for creating or blending colors. While there is sometimes a fine line between drawing and editing, editing refers to the process of modifying a drawing or painting in some way. File management refers to the process of naming, storing and retrieving computer-based paintings.

The newer paint programs cannot be understood without some reference to two developments brought to microcomputing with the Macintosh, but quickly adapted by other microcomputers: the mouse and pull-down menus. The mouse is a device which capitalizes on advantages of human hand-eye coordination; moving the mouse on a flat surface causes a corresponding pointer to move about on the screen. Once a desired point on the screen has been reached, a signal can be sent to the microcomputer by clicking a button located on the top of the mouse.

Pull-down menus are a further elaboration of mouse capabilities which assist the limited short-term memory range of computer users. A menu bar of general choices appears across the top of the screen. Using the mouse, the arrow is made to fall inside one of these choices. The mouse button is depressed and held down, and a new list of choices falling within that menu category appear. The mouse can then be "pulled down" to the desired choice from this list and the mouse button released in order to make the selection. A corresponding key-stroke symbol is usually available for these choices.

The screen of a typical drawing program features a pull-down menu bar at the top of the screen showing the major functions of the program. At other convenient places on the screen appear a narrow menu of drawing options and a palette of colors and patterns. The drawing "canvas" is the remainder of the screen, usually white.

Drawing with a paint program is rewarding. The drawing tools menu contains icons representing the various choices. By pointing and clicking the mouse one can select a color and a pencil of various sizes or a spray paint can and begin to draw free-hand or trace a screen overlay by moving the mouse. Other drawing options permit the drawing of lines and various geometric figures using the mouse. Finally, any area enclosed by previously drawn lines may be filled with any color or pattern from the palette. Text may be written anywhere on the screen in a variety of fonts and sizes.

Painting or coloring paint program drawings is convenient. One of the tools is the fill option. Typically, there is a palette of sixteen colors on the screen. Clicking on any color selects it. When the fill option is activated, simply placing the pointer inside of an enclosed figure and clicking the mouse fills the figure with the active color. In one program, it is possible to create "gradient fill" colors, so that, for example, a sky grading from dark to light can be created with a single press of a button. Drawing pens and the spray can can also be used for coloring purposes.

There is a great variety of color from which to choose. Because the hue of a color is represented by three color vectors, any combination of these vectors represents a unique hue. In one popular program there are sixteen values for each of these vectors, giving a possibility of 16 x 16 x 16 or 4,096 hues. Unfortunately, only sixteen of these colors can be active on any screen. Any sixteen colors can be loaded and saved as a palette.

It is in the edit features of these programs that we find some of their most amazing strengths. Just as in a word processor, parts of drawings can be cut, copied or pasted in any desired position. In addition, sections of drawings or objects can be "lassoed" and then flipped horizontally and vertically, or rotated. This is especially useful for creating reflected images. The drawing can be greatly enlarged, so that individual pixels can be easily altered. "Mirrors" and grids are available that allow the construction of symmetrical drawings.

Color editing is equally impressive. Any color on a palette bar can be altered slightly or entirely. The programs then automatically change the color as it appears in the drawing. Whole new palettes can be imported into a drawing--for example, a gray-tone drawing can be automatically converted to sepia or high contrast black and white. And, perhaps most impressive of all, colors can be mixed and remixed according to precise principles of color combination.

Implications

A major aim of aesthetic educators is certainly to the develop skills in the creation and appreciation of art objects, both representational and non-representational. While this matter remains to be formally and carefully studied, I believe that the capabilities of the digitizer and the paint program can be combined to effect a significant medium to achieve this aim. My belief is based in my own exploration of the limitations of this medium and my observations of the similar explorations of a few children and young adults.

Of course, the point of aesthetic education is far broader than the development of skills relevant to representational art production and appreciation. But the fact remains that many students and their parents still equate worthwhile art with representational art. One of the appeals of photography, for example, is that it appeals to those of us who appreciate the representational component in an aesthetic object. Similarly, using the digitizer in concert with selecting video images requires attention to many of the aesthetic components of a visual image--composition, line, form, color, and contrast. Yet an appealing end-product may be produced without the development of a set of complex drawing skills. Helmick's (1983) article on stochastically generated computer graphics is interesting in this respect. He identifies randomness and selectivity as two phases of the stochastic creative process. He asserts, "one's aesthetic sensibility will allow only those potential solutions that are aesthetically acceptable to be passed to the conscious mind." (p. 38)

Effective methods do exist for the development of skills for producing representational art. For example, the book Drawing on the Right Side of the Brain (Edwards, 1981) has been widely read and successfully followed. But the point is that one of the considerations that most frequently discourages students in their pursuit of drawing skills is that their initial attempts seem to them to be visually unrewarding. The necessity for computer skills notwithstanding, digitizing offers a process that can produce immediate rewards.

Digitized images may be imported into paint programs, and this can lead to some astonishing successes. If someone's goal is representational art, he or she frequently finds that the digitized image does not quite correspond to that being represented. Paint programs or digitizing software can be used to move the representation more closely toward the represented image in color, form, or composition. Colors may be modified throughout the picture or toned differently in a specific area. Subjects may be outlined or otherwise highlighted. Distracting objects may be erased.

Paint programs also excel at facilitating the production of art that moves slightly away from representational. Sections of digitized photographs can be cut and pasted into a collage. Color palettes can be developed which highlight contrast or give surrealistic effect. Moreover, these image modifications require no drawing skill. Finally, paint programs can be use to create abstract drawings. In fact, they lend themselves to the rapid creation of interesting combinations of form and color. Almost all actions, too, are reversible, so that experiments can be made without fear of loosing the original.

At the level of theory, paint programs and digitizing software may be used to illustrate the principles of color blending. A teacher may give a concrete demonstration that when red is gradually added to blue, purple results using the color mixing features of these programs. The difference between saturation and brightness can be displayed by increasing first the amount of gray tone and then the amount of white that a certain color contains.

Summary and Conclusion

I have proposed that the creation of microcomputer graphics using digitizing and paint programs has important significance for the development of visual literacy, defined as the ability to encode and decode the meanings in visual images, and at a higher level to create meaningful visual images. Using digitizers one can take nearly any form of video image and translate it into excellent microcomputer graphics. Since the digitizer analyzes light into its component parts, it is easy to modify these components in the microcomputer. Paint programs permit the creation and modification of digitized or other graphic microcomputer images. The mouse and pull down menus and drawing, coloring and editing tools make this possible.

The digitizer allows the easy production of representational images, and can be used to call attention to aesthetic components of a visual image. When imported into paint programs, the aesthetic components of these images may be modified easily. Paint programs excel in the production of interesting non-representational art. Paint programs may also be used to illustrate principles of color mixing and form creation. Using these new tools does not require the kind of investment in time and energy that drawing and painting traditionally requires, although it does require a certain amount of computer literacy. Hopefully, those interested in aesthetic education will explore digitizing and paint programs.

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Photography as an Intervention Strategy in the Verbal Composing Process

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The present investigation examined the verbal and photographic composing processes of four college freshmen using the tools of instant photography and writing. Assuming that there was an underlying relationship between the verbal and photographic composing processes, a perceptual identification model was designed to 1) identify the similarities and differences between the two processes, 2) examine the effect of photographic intervention on the verbal composing processes, and 3) ascertain the role of perception in the processes. Thus, the objective was not to test specific hypotheses but to describe shared patterns that marked the verbal and photographic processes and to assess the role of perception therein.

The population studied included students who were enrolled in their second semester of freshman English. Five protocols were collected from each of the four randomly selected students. Data consisted of transcriptions of tape recordings of the subjects' oral verbalization of inner speech as they composed written and photographic products. The subjects participated in three writing sessions and two photographic sessions over a five-day period.

The research design utilized protocol analysis and the case-study method in accordance with the investigations of Emig (1971) and Flower and Hayes (1977-78). The descriptive procedure was on the order of a frame within a frame, a device used in literature (Chaucer's Canterbury Tales). There were three frames encompassing the protocols. Frame A was based on Bruner's (1973) formulations on perception, Frame B was based on Bloom and Broder's (1950) observations on foreground-background, and Frame C was the case-study frame.

A descriptive analysis of the protocol data yielded the following findings: 1) the non-discriminatory instant photograph generated visual awareness of formerly gated material, 2) there was evidence of non-specific transfer from the photographic intervention to the verbal composing processes, 3) specific perceptual elements appeared to arise in recognizable and consistent patterns in both composing processes, 4) the photographic process was characterized as silent, rapid, and holistic (non-verbal, rational, and simultaneous), and 5) the protocol method of data collection apparently facilitated the subjects' self-discovery of composing strategies.

The following statements elaborate on the above findings. First, a close look (by the subject) at the instant photograph increased awareness of focal-point strength; this in turn enabled the subject to collapse the focal point and see previously unseen foreground-background relationships. The increase in visual awareness was progressive and could be identified in all remaining protocols. Evidence of this increase in visual awareness was documented by the instant photograph, the protocol transcriptions, and the investigator's on-the-spot observations.

Secondly, a marked change in writing style for one subject indicated the possibility of non-specific transfer from the photographic intervention to the verbal composing process. Further evidence of the effects of the photographic intervention surfaced in the photographic protocols of two subjects when they were able to see the relationship between the scene being photographed and a possible essay topic. Data from the first photographic protocol session and the final group discussion session revealed that one subject had been able to identify and label thought processes as a result of the photographic sessions.

Thirdly, the descriptive analysis of the protocols in this inquiry provided evidence of the significance of perception in all four subjects' verbal and photographic processes. The perceptual elements identifiable within the protocols were: 1) an expectancy state, category accessibility, needs, and ongoing enterprises, 2) the four basic acts of the decision-sequence stage--primitive categorization, cue search, confirmation check, and confirmation completion, and 3) the mediating mechanisms of gating and disruption. The most consistent perceptual pattern emerging from the analysis of the data was the four stages of the decision sequence. This pattern suggests a possible stage sequence of composing in both the verbal and photographic processes. The majority of similarities and differences among the processes occurred here.

Fourth, the salient differences found between the verbal composing process and the photographic composing process were in the areas of silence, speed, and completion. The photographic process occurred silently and surfaced in a matter of seconds as an instantaneous whole. The verbal protocols of the photographic process indicated that, if the verbal mode intervened in the photographic process prior to its completion, the process was slowed down considerably.

Finally, the oral verbalization of inner speech provided the impetus for subjects to identify composing strategies and actual mental operations occurring during the verbal and photographic composing processes. Evidence of this strategy identification appeared throughout the protocol transcriptions.

One of the intentions of this investigation was to bridge the gap between the verbal and visual composing processes of college freshmen--in other words, to determine whether or not photography functioning as an intervention strategy would have a discernible connection with, or have an effect on, the subject's verbal composing processes.

An analysis of the photographic protocols revealed that the instant photograph (the product) forced the subject to confront material which was actually gated in the photographic composing process. This visual confrontation illustrated that photography, by virtue of a frozen, non-discriminating, visual image, inevitably established a keener sense of awareness on the part of the subject which carried over to the next photographic session. By the time the subjects reached the final verbal sessions, they were beginning to make some transfer of this increased awareness in their visual processes to an increased awareness of details in their verbal processes. A major implication here is that instant photography may be a valuable tool in the facilitation of a student's verbal composing process. Instant photography may be especially helpful to the student who gates a great deal of material and then creates compositions filled with generalizations with virtually no supporting details.

Next, the student's use of visual images in both the verbal composing process and the photographic composing process should be considered. All four of the subjects used some form of visual imagery as a strategy. In the verbal composing processes, the subjects seemed to form pictures in their mind's eye. Next, the subjects attempted to create a written description of the scene formulated in their minds. In the photographic composing processes, the students pre-visualized the final photographic product. If the product matched the mind's image, the student responded favorably. However, if there were any discrepancies, the student would respond negatively and sometimes retake the picture.

Worth mentioning at this point is Bruner's (1973) view of the visualization strategy. Bruner refers to this visualization as ikonic representation as opposed to the more advanced symbolic representation where the word rather than the picture symbolizes the element. The implication here is that the student who constantly visualizes is at Piaget's (1955) concrete-operations level and thus unable to use language to describe abstract relations. According to Smith (1977), Bruner is suggesting that it is the written language which can enhance the cognitive growth necessary to move the student to Piaget's formal-operations level.

Perhaps somewhat contrary to Bruner's views are the right-brain, left-brain theories (Edwards, 1979). Theoretically, the student who visualizes may be right-brain dominated and in need of learning experiences which promote visual literacy as well as verbal literacy. Regardless of the somewhat mixed views about the student's use of visualization in the verbal composing processes, the overall implications are evident. In response to the visual orientation of students, the teacher of freshman composition must become more astute at identifying the visually versus verbally oriented student and at creating heuristics which will enhance the verbal composing processes of the visually oriented student. A specific example of photography as heruistic would be to ask the students to photograph something abstract such as love, fear, pity, or happiness. Next, the students would discuss the photographs with the instructor and then create a composition based on the photograph. In brief, for some students the medium of print may be the best means of communication. However, for students who may be predominantly visual learners, the film, the word processor, or another medium may be more effective. The teacher's sensitivity to the student's process, not just the product is the key.

As mentioned earlier, there was no clear-cut indication that the photographic intervention had a definite effect on the verbal composing processes. Nevertheless, during the intervention protocols, one subject's writing process changed considerably, and all subjects developed an increasing awareness in regard to gated materials. Furthermore, by the fifth protocol session, two subjects began to see some type of relationship between their verbal and photographic composing processes. This type of transfer can be especially valuable to students who are visually oriented and who have difficulty with more written assignments. Teachers of composition should be cognizant of the possibility that instant photography may facilitate the verbal composing process of seemingly below average and often visually oriented students.

Concluding Statement

In the spring of 1983, Americans were told by the National Commission on Excellence in Education that "our nation is at risk,' that it faces a "rising tide of mediocrity that threatens our very future as a nation and as a people" (Gardner, 1983). According to Beverly Anderson (1983), Director of the National Assessment of Education Progress, "the blunt truth is that American students are making little or no progress in improving their thinking and problem-solving skills" (p. F1). Anderson's observation is echoed in a comment made by Karen Young during this investigation, Karen, an 18-year-old freshman who had never traveled more than 75 miles from rural Franklin County, Virginia, remarked: "I mean there's a whole lot of students that their problem with writing is that they don't like to think, and if I didn't think, there's no way I could write a paper."

In fact, many English teachers have maintained all along that the best way to teach effective thinking is through the teaching of writing, including grammar and literature. Why, then, after 15 years of numerous reports on higher education and much process research in the area of English composition, are American youth still unable to write, unable to think? Is the reason, as Karen says, that "they don't like to think," or, at the risk of going out on the proverbial limb, is it because the emphasis in American education has been on one type of thinking, "verbal," to the neglect of "visual" or "sight" thinking? With such a large portion of knowledge and information coming through visual channels, it is difficult to comprehend why so little has been done to make use of visual, right-brain thinking when it may be a necessary partner to the verbal process of thinking.

There appears to be a definite need for the concerted effort which has characterized verbal learning to be applied equally to visual and perceptual learning. Photography may prove to be a valuable tool in effecting this change.

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Mixing Verbal, Visual, Motoric Elements in Instruction: What's Good and What's Not

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Introduction.

For the last few years my work has dealt with both theoretical and practical aspects of how to combine elements in multimedia instruction for effective learning. By multimedia I mean verbal (spoken or written text), visual (typically moving video from videotape or videodisc), and motoric (actually performing a task, such as assembling or repairing a real physical object). The purpose of this paper is to report four empirical studies, each of which yields a practical principle for designing and using multimedia instruction. We begin with very brief descriptions of the theoretical framework and our experimental approach.

The Theoretical Framework.

When we think, we use concepts; and concepts reside in our memory. One way for us to form or modify our concepts (i.e., to learn) is by using processors, which obtain information from the environment and put it in memory. The three processors of interest in this paper are the verbal, visual, and motoric processors. As above, the verbal processor attends to spoken or written text, the visual to moving or still images, and the motoric to actions. In our framework (Baggett, Ehrenfeucht, and Hanna, 1987), elements coming from different modalities can become parts of the *same* concept. For example, the name of an object, what it looks like, and the actions one performs on it, can be included in a single concept. Each is put into the concept by the appropriate processor. The situation is depicted in Figure 1.

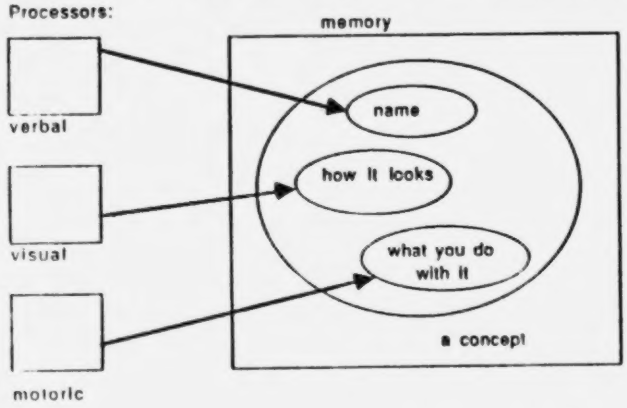

Figure 1
A Framework for Multimedia Concepts in Memory

Experimental Approach.

Our approach is to vary when subjects in different experimental conditions are presented with the different elements (verbal, visual, and motoric) in instruction. We then test half the subjects immediately after they have studied the instruction, to get a measure of what they have *encoded*. We test the other half a week later, to look at *retention* of the material. We assume that a text contains verbal (written) material; a video with a soundtrack contains visual and verbal (spoken) material; and a task in which there is a performance element contains both visual (one *sees* it) and motoric (one *does* it) material.

The goal, using this approach, is to find principles to give to educators, instructional designers, etc., about how to design multimedia instructions for good encoding and retention. We now turn to the four studies.

Study One: Encoding and Retaining Information in the Visuals and Verbals of an Educational Film.

The questions this study was designed to answer are

1. How good is encoding and retention of the material (visual and verbal) in an educational film?
2. Is there a problem when information from two media (visual and narration) is presented simultaneously? I.e., when a person encodes information from one source, does he or she have trouble encoding information from another source at the same time? Theoretically, do two processors compete for the same resources?
3. Will information extraction be improved if we present the information from the two media sequentially, thereby *doubling* study time?

The film we used was Plant Traps: Insect Catchers of the Bog Jungle. It was 16 mm, sound (voice over) and color, eleven minutes long, with 1270 words of narration. The full study is in Baggett & Ehrenfeucht (1983); we report data from only ten groups here. The first five of these are (1) watch intact film, get test at zero delay; (2) listen to narration with visuals turned off, then watch visuals with sound turned off; get test at zero delay; (3) read the narration from printed text (study it for eleven minutes), then watch visuals with sound turned off; get test at zero delay; (4) watch visuals with sound turned off, then listen to narration with visuals turned off; get test at zero delay; (5) watch visuals with sound turned off, then read text (study it for eleven minutes); get test at zero delay. The other five groups are identical to these, except that they were tested after a seven-day delay. Notice that the film groups study eleven minutes; the other groups study twenty-two minutes.

The dependent measure was percentage correct on sixty-three true-false, multiple choice, and short answer questions. Examples of the three types of questions are:
True or false: Sundew plants are more active toward live than toward dead prey. (Answer: True)
Multiple choice: How fast can a healthy Venus flytrap shut? Pick the most accurate answer. (a) in less than one-tenth second; (b) in less than one-half second; (c) in less than three seconds; (d) in less than ten seconds. (Answer: b)
Short answer: What attracts insects to the pitcher plant? (Answer: perfume). Results are given in Table 1.

Table 1

Percentage correct on sixty-three questions

	tested at:	
Group:	zero delay	seven-day delay
watch movie	69	54
1. listen to narration; 2. watch visuals	50	51
1. read text; 2. watch visuals	66	57
1. watch visuals; 2. listen to narration	61	53
1. watch visuals; 2. read text	67	57

Note: Data from ten groups are reported. The movie groups study eleven minutes; the other groups study twenty-two minutes.

The interpretation is very straight forward. There is no evidence that there is a problem when information from two media is presented simultaneously. The film groups perform as well (statistically) as all other groups (and better, when tested at zero delay, than the group that listens to the narration and then watches visuals), even though they study the material half as long. There is no advantage for doubling study time. The college students tested in this study are good dual media processors.

There are of course some unresearched and unanswered questions about film comprehension. For example, in the Plant Traps film there were 1270 words of narration spread over eleven minutes. How much denser can the narration be and still be comprehended? And how should it be related to what is being shown? How often does the viewer need to see it and hear it, in order for the material be knitted together? How important is the juxtaposition of shots, or montage? Just as there are readability formulas for text, could a meaningful viewability formula for movies be developed?

Study Two: The Role of Temporal Overlap of Visual and Verbal Material in Forming Dual Media Associations.

The question in this study was, how close together in time do an object and its name need to occur in a film in order for people to be able to recall the name later, given the object? In addition, is it better for the visual information to occur before, in synchrony with, or after the verbal label? The study is fully reported in Baggett (1984); only a summary is given here.

The film we used was thirty-three minutes long, in color, and super 8. It was shot and edited by James Otis, a professional film maker. It featured forty-eight pieces in an assembly kit (Fischer-Technik 50), their names, and some of their uses. The names in the narration were carefully designed to be simple, short, easily matched with their physical referents, and fairly well recalled.

Fourteen groups of subjects (college students), twenty-four per group, watched the film in one of seven temporal overlap conditions. A part's name could occur twenty-one, fourteen, or seven seconds sec before the part was shown, in synchrony with when it was shown, or seven, fourteen, or twenty-one seconds after it was shown. The narration and visuals were the same for all conditions. All that varied was the overlap in time of corresponding elements. In the extreme conditions (visuals twenty-one seconds before or after the appropriate narration) the viewer occasionally could be hearing about piece X while seeing piece Y. After the film and at the appropriate delay (zero or seven-day) each subject was given a collection of the forty-eight actual pieces from the kit and asked to write down the pieces' names, exactly as they had been given in the film.

The dependent measure was the percentace correct on recall of the names, using the pieces as cues. A strict scoring criterion was used. Any deviation from exactly correct was scored as wrong. Figure 2 is a graph of percentages correct for each of the fourteen

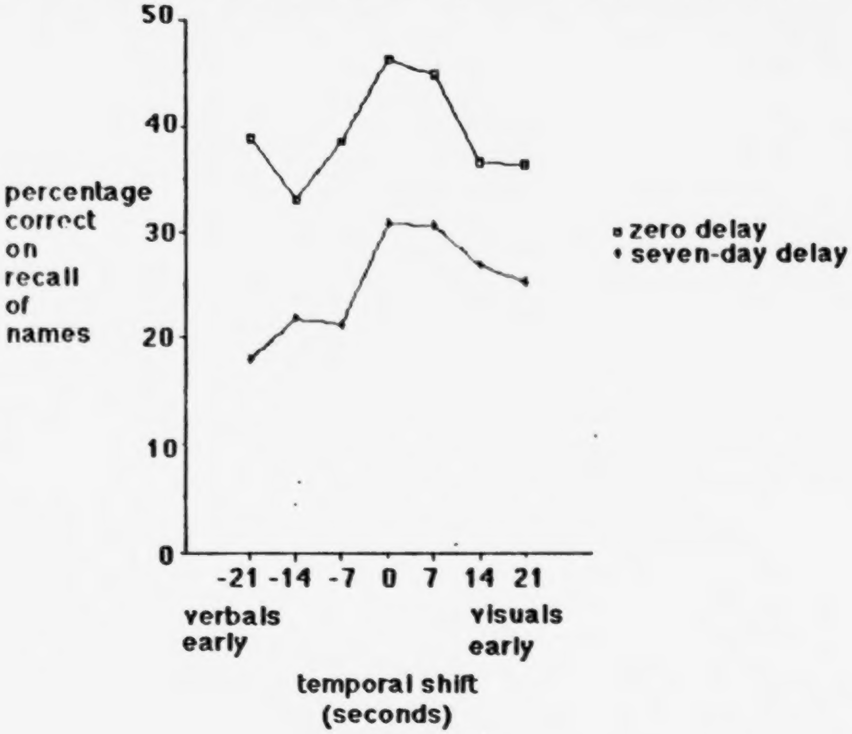

Figure 2

Percentage correct recall of names of pieces, given pieces as cues, as a function of type of temporal overlap of visuals and verbals. Fourteen groups, twenty-four subjects per group, are presented.

groups. The statistical analysis showed that two groups scored highest and about equally at zero delay, the synchrony group and the group with visuals seven seconds before narration. The same two groups also scored highest and about equally after a seven-day delay. On the immediate test, the scores for each of the other five groups were about eighty percent of those of the highest groups. On the test after seven days, the other five groups scored slightly though not significantly differently: The three narration-first groups (on the left in Figure 2) performed about thirty percent less well than did the two visuals-first groups.

The temporal order in which visual and auditory elements are presented differentially influences the formation of dual-media associations. When auditory elements precede visual elements, much of the auditory component is lost.

The main finding is an asynchrony in the temporal shift, as shown in Figure 2. When visuals precede narration by up to seven seconds, recall is as good as when visuals and narration are in synchrony. When narration precedes visuals by seven seconds or more, much of the narration is lost, especially after a delay.

One theoretical account of the finding comes from the mental imagery framework (Kosslyn, 1980; Paivio, 1971). Linguistic material representing concrete concepts, according to this framework, automatically creates visual images. The visual images created are based on previous visual inputs. When verbal material follows visual material, the verbal material becomes associated with the just-presented visual image. When verbal material precedes visual material, the visual images with which it associates (call them V) are not necessarily related to the next visual image to come (call it V1). The visual images automatically associated (V) make the correct association with V1 difficult. This framework predicts that visuals and narration in synchrony, or narration following viusals, will cause the best associations to be formed.

If the mental imagery hypothesis is not rejected by future experiments, the practical application to film makers of where to put narration is clear. In a dual-media presentation, the narration should shortly follow, or be in synchrony with, the visual image and should not precede it.

Theoretically, the correct temporal overlap of visuals and narration should not be restricted only to films with voice-over narration. It should hold as well for illustrated lectures, slide shows, written text with pictures, and so on. The principle is simple. If one's objective is associative recall of names of objects, one should present the visual part early or simultaneously with the text. It is better form the visual component to precede the text rather than vice versa.

Study Three: Learning a Procedure from Multimedia Instructions: the Effects of Film and Practice.

In this study we added motoric elements to film/video instruction. The task was to learn to put together from memory a 54-piece toy helicopter. The instructions available were (1) a fifteen minute color film showing its assembly (containing visual and verbal elements), and (2) copying from an actual physical model (containing motoric and visual elements). The main question was, what presentation or combinations of presentations lead to good performance in building the helicopter from memory?

Twelve groups of college students participated, with thirty subjects (fifteen males and fifteen females) per group. Six of the groups were tested from memory immediately after their instruction, and the other six were tested after a seven-day delay. The results are shown in Table 2. The dependent measure is percentage of correct connections in the helicopter built from memory. To obtain this score, an abstract graph of each person's helicopter built from memory was drawn. Pieces were drawn as nodes, and physical connections were drawn as links. This graph was compared to a graph of the correctly assembled helicopter. The number of correct connections was counted, and changed to a percentage.

The groups line up as follows at zero delay (M = build from model; F = see film):

MM = MF = FM > FF = M > F

Table 2

Percentage correct connections in helicopter built from memory after various combinations of instructions

group:	1.see film	1.build from model	1.see film	1.build from model	1.see film	1.build from model
	2.build from model	2.see film	2.build from model	2.build from model	----	----
tested at:						
zero delay	80	80	69	85	37	68
seven-day delay	41	52	32	42	20	39

Note. Data from twelve groups of college students (thirty subjects/group) are reported.

Clearly, for the best performance a motoric element is needed, together with something else (either visual/verbal from film, or a repetition of practice). The FF and M groups are tied for second at zero delay. It is interesting that audiovisual instruction, given twice, gives as good performance as practice once.

After a week delay, the groups line up as follows:

MF > MM = FM = M = FF > F

The F group is still poorest. The FF and M groups remain together, but with a change of order from their zero-delay rankings. (FF is slightly but not significantly worse.)

An important finding is that the performance of the MM group is not statistically different from that of the M group after a week, although they were significantly different at zero delay. The MF group performed best (and significantly so) after the delay. We propose, based on this result, that elements in people's concepts form a precedence. Primary is motoric, second is visual, and third is verbal. We observe the similarity of our precedence of modalities idea to the work of Bruner (1966) on cognitive development. Growth is characterized, according to Bruner, by increasing independence of response from the immediate nature of the stimulus. He suggests that the world is represented in three different modes: enactive, iconic, and sympolic. The enactive mode involves representation through action itself; the iconic involves using images to represent action; and the symbolic represents things in an arbitrary or remote way. As a child grows, the ability to form and use the representations proceeds from enactive to iconic to symbolic. Our findings suggest that, for adults, concepts are formed best when information is presented first enactively, second iconically, and third symbolically. If our results are valid, the formation of mental structures in our task parallels cognitive development.

Study Four: The Role of Practice in Videodisc-based Procedural Instructions.

In this study college students watched videodisc-based procedural instructions which showed how to assemble an eighty-piece object, a lift (shown in Figure 3). Some groups were allowed to build the lift once on-line, as they studied the instructions. Other groups did not build on-line, but merely studied the instructions. The main question was, what role does practicing during interactive instructions have, when the test is to build the object later (either at zero- or seven-day delay)? The complete report of this experiment is given in Baggett (1988); we give only the highlights here.

The equipment used was IBM's InfoWindow system. Input was from keyboard or touchscreen, and the output was moving and still video from videodisc, with text and graphics overlay, and three sources of speech, two from the videodisc soundtrack and one from a limited speech synthesizer. We used the Composer/Conductor software (now marketed as IWPS, InfoWindow Presentation System), which has a spreadsheet design and which automatically keeps a time-stamped record of everything the user does. It was a one-screen system.

The videodisc instructions were designed as follows (see Baggett & Ehrenfeucht, 1988, for details). A group of subjects built the lift a total of forty-seven times, copying from a physical model. The order in which each subject selected the pieces for assembly was recorded. Using a computer package for cluster analysis by Perry (1983), the "most typical" conceptualization (breakdown into parts, subparts, etc.) among the forty-seven was selected. (Seventy percent of subjects' conceptualizations were minor variants of this "typical" one.) A videotape showing assembly of the lift was made, based on the typical hierarchical structure and on the particular subject's order of selecting pieces. The videotape was shot top down, depth first, and the steps were shown in an executable order. Two cameras were used, one showing the current goal (or subassembly) and the other showing hands working toward the goal. In addition, each subassembly contained a two-part sequence: (1) get the pieces needed; and (2) assemble the part. The instructions were thus modularized into "natural" conceptual units.

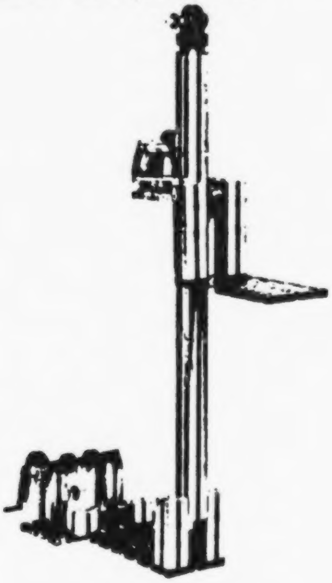

Figure 3

A lift consisting of 80 pieces from the Fischer-Technik assembly kit. It is the object assembled in Study 4.

The videotape instructions were also "optimized" according to two other parameters analyzed in previous studies:
(1) The verbal descriptions (names) used in the narration have been shown to be better than some others. They were selected from collections of names generated by subjects.
(2) The temporal overlap of visual material and spoken narration leads to good associations; the visual material precedes or is in synchrony with the spoken material; spoken does not precede visual.

The twenty-seven minute long videodisc was pressed from the videotape. The design was as follows:

- Just as with the videotape, the assembly was modularized into conceptual units, showing a step-by-step executable procedure, with "get pieces" and "assemble part" subunits.
- The only input permitted from the subject was touches to the touch screen (no keyboard input). From touches, a viewer could manipulate what was seen.
- The viewer was forced to see all information once. (No information could be skipped.) The subject could not skip around in the presentation but had to see the assembly in a predetermined executable order.
- The presentation stopped at the end of each conceptual subunit (e.g., "get" or "assemble"), giving a still frame. The subject could continue or replay with a touch.

(Words used as instructions for touches appeared at the bottom of the screen as text over moving or still video.)

- During replay of a unit, the viewer could touch the word "next" and skip the rest of the replay, moving to the next unit.
- Subjects could stop the video at any time, by touching "pause." This gave a still frame. They could resume the video by touching "resume."
- The presentation was not menu-based. That is, while choices were available, they were not hierarchically arranged, and they were typically of the form "next" or "replay."

We report data from four groups. Two built on-line as they viewed, and two did not build on line. Half the groups built the lift from memory immediately after the instruction, and the other half built after a week. Table 3 reports the results, for both structure and efficiency. The structure score was determined as in the helicopter study above.

Table 3

Number of correct connection in lift built from memory (104 possible) and efficiency (= number of correct connections per minute of work time; work time = study time + memory trial time) as a function of delay (zero versus seven-day) and whether or not subjects built the lift on-line as they studied the instructions.

delay		subjects built on line	subjects did not build on line
zero	number of correct connections	52	60
	efficiency	.51	.65
7-day	number of correct connections	43	41
	efficiency	.30	.36

Note: There is a main effect of delay on all scores. The efficiency measures at zero delay are significantly different: People who do not practice on line are more efficient than people who do not. There were thirty-two college students in each group.

The remarkable result is that there is no difference in perfoming from memory in the groups that built on line and those that did not build on line! And at zero delay, the group that did not build on line is actually significantly more efficient that the group that did!

In this study, we thought practice would help. But it didn't. And sometimes (in terms of efficiency) it was actually detrimental. We hypothesize that in this task, practicing (motoric execution) actually detracts from concept formation. We hypothesize the following:

- People should not be forced to practice during their learning period.
- Physical movements distract a person from paying attention.
- People should not be made to practice a skill when they are forming concepts.
- Learning takes place either before or after the action, and not during the action.
- People don't think at the moment they perform actions. There is a kind of sequentiality: plan, execute, reflect.
- The analogy is that practicing is mainly executing an algorithm and is noncognitive.

Concluding Remarks.

In this paper we have reviewed four studies dealing with how to combine verbal, visual, and motoric elements for effective instruction. We have found:

- College students comprehend information in a film just as well when visual and verbal elements are presented simultaneously, as when they are presented sequentially, doubling study time.
- In a dual media presentation, for good encoding and good retention, visuals should be in synchrony with verbal or precede them by up to seven seconds. Visuals should not follow verbals.
- In adding practice, when tasks are sequential, motoric should precede audiovisual. When tasks are simultaneous, motoric (practice) doesn't seem to help, and sometimes seems to hurt. Why? A hypothesis is that when people are building mental models, building physical models gets in the way.

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Teaching Visual Literacy Through Newspeak: A Unit Model for Integrating Visual Literacy Principles and Practices in the Secondary English Classroom

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It is estimated that every day we are exposed to about fifteen hundred advertisements. They bombard us from when we read the newspaper with our morning coffee to when we turn off the 11 o'clock news on television before going to bed. While the total number is vast, however, only a very few enter our consciousness. Like all other stimuli which impinge on our senses, advertisements are screened by an automatic selective perception process. What we see is determined by what we already know, believe and want. Only those ads which speak directly to our immediate felt needs or to our perceived long-term self-interest--and which do so in the first few seconds of exposure--make it through our mental screening process.

Because of this, the major print advertising research services focus first on the noticeability of the ad to measure its effectiveness. Starch, for example, rates print ads as "Noted," "Advertiser Associated" and "Read Most" [of the copy]. Gallup and Robinson measures "Proved Name Registration" and "Favorable Buying Attitude." Both researchers in print ad effectiveness look first for the ad's ability to stop the reader (in the belief that an ad cannot effectively sell unless it is first noticed), and then for reader association between the advertisement and the advertiser (under the assumption that if both are not united in the reader's mind, the ad has not done its job for the client).

While ultimately neither company can measure whether or not the ad did its final job of selling a product, service or idea, both nevertheless recognize the fact that the ad cannot sell until it is noticed. It is this concentration on receptor awareness which has made advertising researchers focus primarily on advertising's visual aspects in its ability to communicate with its target market: visual language is more concise and more easily and quickly processed than verbal language, whose symbology is more abstract and hence more difficult to process.

Witness, for example, the effectiveness of cigarette advertising which relies almost totally on visual language to get its message across. While cigarette manufacturers--and advertising agencies with cigarette accounts--defend their product messages with rational appeals to the Constitution's First Amendment "freedom of speech" guarantee and with arguments that their advertisements contain important information for the potential consumer, they artfully refer only to the verbal language content of their advertisements. The reality of their message, of course, is contained not in verbal language, but in the visual language which dominates their ads.

While verbal language must be consciously processed to achieve its effect, much of visual communication takes place almost instantaneously at the unconscious and emotional level; and since approximately ninety-eight percent of typical cigarette ad space is occupied by a positive image, with a mere two percent devoted to a negative verbal warning, the primary impact of the message is felt visually and emotionally rather than verbally and rationally. Just as Freud suggested that the processes of condensation and displacement are used by the psyche to evade its censor, so, too, cigarette advertisers can use apparently inoffensive yet symbolically loaded images to evade legislative censure. The positive illustration "condenses" the logically disparate images of cigarette smoking and social-sexual behavior into a single, emotionally persuasive image, while the cigarette "displaces" explicit sexual referents. The resulting message? Smoking is a socially positive, sexy act.

Thus when the dominant visual message says "healthy, active, happy, self-assured, independent, socially accepted," and the brief verbal message says "lung cancer," it is the positive message which makes its way into the consciousness of the consumer, not the negative. Recognizing that consumers read visual language more quickly and easily than verbal language, and that consumers block out negative messages in favor of positive messages, advertisers and their agency representatives play a psychological and semantic game with legislators and the public in order to keep their profits high. If the legislative standards for false advertising truly recognized visual language as the prime medium of communication that it is, their application to cigarette advertising would mandate images not of happy, healthy, clean-cut people, but images of cancerous lung tissue, diseased coughers, and death.

Yet advertisers sometimes also overlook the power of visual illustration to communicate the message quickly and clearly, as witnessed by the growing trend toward the use of headlines as illustration, especially when the product benefit is an abstract rather than concrete one. But when art directors substitute words for images, the result is not effective communication, but interesting graphic design--aesthetically appealing, perhaps, but without the impact of a visual message.

If advertising does not communicate visually--primarily through illustration, and secondarily through verbal imagery--it may not communicate its message at all, for it is the illustration which stops the reader and opens the line of communication between the advertiser and the potential consumer.

Good visuals thus do not simply stop the reader; they also begin the communication process by simplifying the product message to its most quickly and easily understood form. In this, they act as condensed symbols, in that they appear as visually reduced statements which suggest more complex ideas and emotions. And at the same time that they simplify the product message for easier understanding, they also actively involve the reader's imagination. In a truly successful ad, the reader will see in the visual illustration a story where he or she is the protagonist, a story which so closely associates the company name and reputation, the product and its benefit, and the reader's need and self-interest, that they merge into a single image.

When the reader of the visual message sees himself or herself in the story, the image has not only achieved product "name registration," but has also emotionally involved the reader in the message and paved the way for product satisfaction through enhancement of the reader's self-image. Illustrations are always attractive, usually concentrated on one or two specific individuals, in medium shot or close-up, who are involved in actions and settings which imply alluring, simple, clean, healthy, and active lifestyles. Verbal messages, on the other hand, usually consist of abstract or difficult words like "fetal injury," and nebulous negative implications like "heart disease" which demand effort to understand or which repel through discomfort-provoking imagery and trigger psychological defense mechanisms.

Cigarette advertisements work because they appeal to adolescent fantasies and encourage identification with people who appear to be sexy, self-contained, self-assured, and thoroughly in control of their individual and social lives. In other words, they work because they precisely target those anxieties which plague most adolescents--as well as their "adult" counterparts.

In understanding the positive and negative impact of advertising's visual and verbal language, therefore, it is important to recognize the profound strength of this aspect of advertising: that product users are self-identification seekers as well as product benefit purchasers. They buy products and services which are not only useful to them but which, in being used, also confirm self-image and in turn send out meaningful messages about themselves. Especially obvious in cigarette advertising's appeal to adolescents in terms of self-acceptance and self-expression, the principle applies equally to everyone in any materialistic society, from alligator emblem wearers to punk rockers.

Effective advertisements create specific and definite symbols, both conscious and unconscious, which can be generally recognized by the public at large, and thus can in turn be used to send out secondary messages through product use. If a certain brand of blue jeans can effectively position itself as "young, sexy and on-the-move," for example, those same jeans, in being worn, will send out the signal that the wearer is also "young, sexy and on-the-move." The same, of course, is true of status automobiles, celebrity-endorsed cosmetics, even orange juice.

When a product or service has been successfully "positioned"--i.e., perfectly matched in consumer personality and product benefit--consumers associate the product with an image of themselves which they either possess or wish to project or both, and then use the positioning to make statements about themselves in terms of personality or social status. In short, successful ads create images which consumers can then use to advertise themselves.

The most successful visuals thus not only target the consumer personality exactly and act as extensions and refinements of the product and its benefit, they also suggest a storyline which the targeted consumer completes in his or her own imagination. This pattern of visual suggestion and psychological closure makes the illustration work simultaneously on both the emotional and the rational level. On the emotional level, the ad gets reader attention through self-identification and achieves reader involvement through closure as he or she completes the ad "story." On the rational level, the illustration simplifies the product message and appeals to rational self-interest through the product benefit.

While it is the function of the illustration in print advertising to capture attention, emotionally involve the reader, and suggest product benefit, the function of the print headline is to verbally reinforce the illustration, link the visual to the verbal, name the brand and spell out the product benefit. To be effective verbally, then, the headline must clarify interpretation of the illustration and complement its visual shorthand with a succinct secondary verbal promise of a consumer benefit which is meaningful on both the rational and emotional level.

The headline of advertising copy thus becomes the equivalent of poetry in its economy of expression and reliance on imagery, acting as an imagistic bridge between the visual illustration and the verbal body copy. If the headline contradicts the visual message of the illustration, the resulting confusion may cause the reader to choose the easier or more positive message as in cigarette advertising, or even to abandon the ad altogether as simply too much bother to understand--since no one feels a personal obligation to work at understanding any advertising message. The reader will always take the easy path, unless the visual is so intriguing that curiosity itself becomes the motivating factor.

When, however, the headline becomes an extension of the illustration into another dimension, verbally repeating and reinforcing the product benefit implied visually in the illustration, the headline smoothes the message and leads the reader into the body copy. Both illustration and headline are synecdochic in this respect. That is, they utilize visual and verbal imagery which focuses on the significant part of the "product story" and which necessarily implies the meaning of the rest--in the same way that "hands" can be used to imply "working bodies" in phrases like "all hands on deck." The more specific, concrete, and suggestive the image projected by the illustration and reinforced by the headline, the more effective the communication.

Likewise, in advertising body copy, amorphous, ambiguous or non-specific wording which conjures no mental imagery lacks advertising effectiveness because it encourages no imaginative involvement on the part the reader. Like the headline which serves as a transition between the visual image of the illustration and the verbal explanation of the body copy, the copy itself must also be synecdochic--it must recount representative details which support the promise of the visual and the headline, selecting language related to the central metaphor of the visual, and facts and figures which imply a larger significance about the entire product experience. Illustration, headline and body copy must work visually and verbally to reinforce a product image perfectly suited to the self-image of the target market.

The totality of the visual language of print advertising is not confined to the image stated directly in the ad's illustration and implicitly in its copy, however. In addition to the ineffective choice and integration of visual and verbal elements, print ads also may fail to communicate because of goals which are too vague or too broad, internal visual and verbal clutter, confusion and distractions within the layout, and lack of readability.

Visually, for example, when advertisers fail to use a single dominant illustration or a single, dominant color in two or three color ads, the result is often a confusion in what to look at first, and a sense of clutter which distracts attention from a single message--a single message which should be both attractive and reinforced visually and verbally. Verbally, "reverse type"--white lettering on a black background-- for example, which has become extremely popular in current ad layouts, can work effectively only when print is confined to very few words and is large enough to read comfortably. While the ad may achieve visual impact from a design standpoint, it lacks communicative ability simply because it lacks ease of readability. If the ad is visually or verbally too difficult or too confusing to read, it just won't be read.

As with any effective communication, the print ad message must be formulated to achieve a specific end; it must be framed in understandable visual and verbal language; visual and verbal imagery must be complementary and involving; and message interference must be overcome in the layout and message design of the ad--if the ad is to succeed in achieving any level of rational and emotional impact.

In other words, if the advertisement or commercial does not effectively utilize visual and verbal language to communicate the product benefit, you'll probably never notice it in your newspaper, even after you've finished your morning coffee, or give it a glance on television, even it it does precede the evening's "hottest" news story. Because of this, when it is effectively composed, advertising provides us with the most condensed and effective form of visual-verbal communication occurring in society today.

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Computer Generated Instructional Graphics

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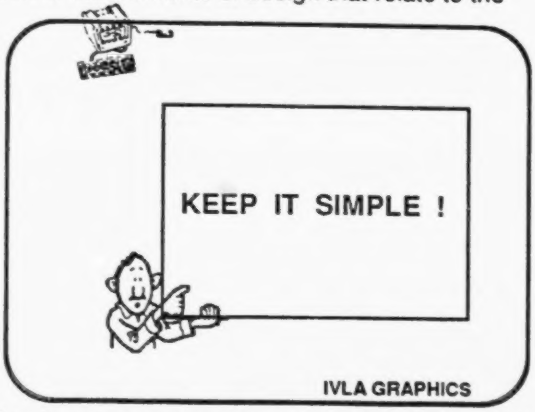
Those of us who have been in the instructional graphics "business" for a long time, have seen the use and abuse of many different aids to graphic production. I remember the day we received our primary-type, typewriter like it was yesterday. Then, of course, there were dry transfer letters, press on letters, lettering guides and the like. Couple these with a thermal copier and WOW! instant graphics. While all of these devices were simple for the teacher to use, there was also the chance for their misuse. Assuming these aids were used correctly we could state that they have their place and it would appear to me that they are still useful under certain circumstances.

The operation of more complex production devices like the Verityper Headliner and type setting devices were left to the Graphic Arts pros. Rules of balance, center of interest, type styles, and type size were usually followed carefully. Now we have computers and we're back to even more WOW! and super instant graphics. The chance for misuse is increased.

While I certainly do not consider myself an expert in graphics design, I do recognize the need for rules and the need to follow rules. With this in mind I offer the following guidelines based on literature review, observation, and experience. Since a discussion of every type of graphic would be too time consuming for this presentation, I will confine my presentation to the elements of design that relate to the development of overhead transparencies.



Guideline #1. **Keep it simple!**

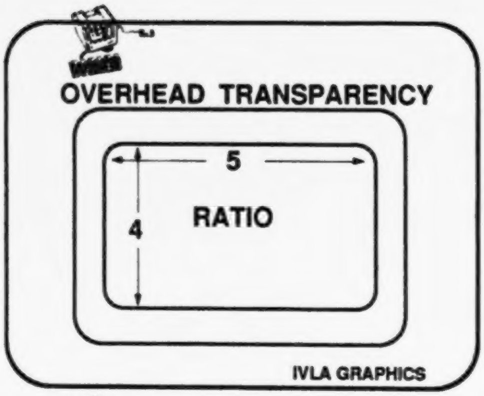
Simple doesn't have to be plain and boring. How many times have you seen a transparency so filled with information and fancy art work that the objective of the graphic is obliterated. There is a happy medium (No pun intended).

Consider the plight of the teacher who is not an artist. In order to create a transparency, he/she, uses cutouts or tracings. Transferring the result to an acetate can also be a problem. Many of these efforts take the form of a xeroxed page from a book, transferred to thermal acetate. Naturally the result is less than satisfying. As a result, many teacher- produced transparencies are void of illustrations. Many of these transparencies are simply typed lines on a page subsequently transferred to an acetate through the thermal process. Here again the result is not pleasing because of inappropriate type style or inadequate letter size. Really, what is the poor teacher to do?

Around the corner comes the computer and an answer to the teacher's prayer. Or so it would seem. The problem still exists. What about graphics design? Will junk be born of simplicity?

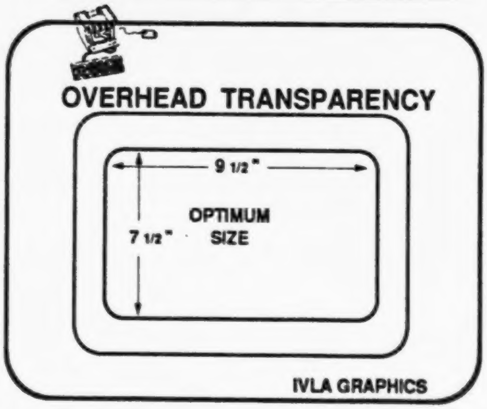
Guideline #2 **Ratio**

The transparency needs to be developed in the appropriate ratio. Literature and convention dictate a ratio of 5 units by 4 units. Most advice from the literature also indicates that the horizontal dimension should be 5 while the vertical dimension should be 4. Since the stage of an overhead projector is 10" by 10" , and since we should be careful not to extend the material to be projected past the edge of the stage, we should develop the material well within the maximum size.


OVERHEAD TRANSPARENCY
5
4
RATIO
IVLA GRAPHICS

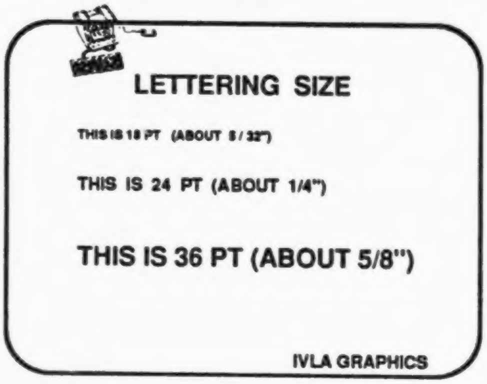
Guideline #3 **Optimum Size**

Here again the literature give us some guidance in this matter. The figures of 9 1/2" horizontal by 7 1/2" vertical seem to prevail. Please note that the longer horizontal dimension appears to be preferred. Regardless of the horizontal or vertical orientation, it is important not to crowd the edges. If the transparency is to be framed (and I recommend framing it) then the material to be projected should be well within the frame.


OVERHEAD TRANSPARENCY
9 1/2"
7 1/2"
OPTIMUM SIZE
IVLA GRAPHICS

Guideline #4 **Lettering Size**

Most of the literature indicates that lettering size should be appropriate for the viewing audience. References to size usually recommend sizes in fractions of inches. Computers usually refer to lettering size as points. Hence 5/32" is about 16 points, 1/4" is about 24 points and 5/8" is about 36 points. (These are close approximations.) Most transparencies need a lettering size of at least 1/4" or about 24 points.


LETTERING SIZE
THIS IS 16 PT (ABOUT 5/32")
THIS IS 24 PT (ABOUT 1/4")
THIS IS 36 PT (ABOUT 5/8")
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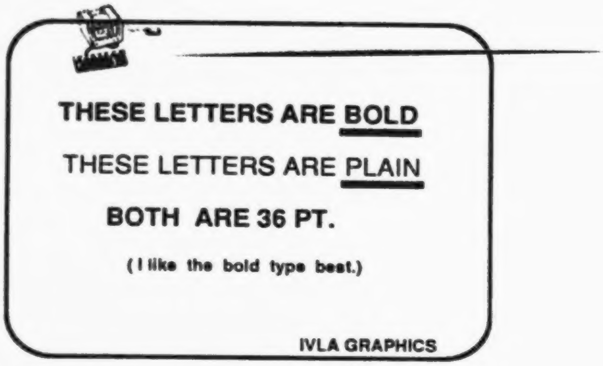
Guideline #5 **Clarity**

When lettering appears on the screen it should stand out. A thin letter will often appear washed out. Sometimes the transfer process will be incomplete and portions of a thin letter will be lost or appear broken. Computers refer to letters as bold or plain. I usually choose the bold option unless there is a reason to make the lettering size less than 24 point.


THESE LETTERS ARE BOLD
THESE LETTERS ARE PLAIN
BOTH ARE 36 PT.
(I like the bold type best.)
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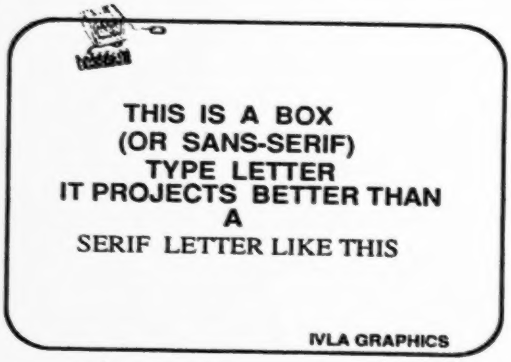
Guideline #6 **Letter Style**

Another phenomenon of projection is that plain box shaped letters are easier to read when reflected from a projection screen than a letter with a curved edge called a serif. As a result, there are many recommendations in the literature which indicate that the sans-serif letter is preferred.

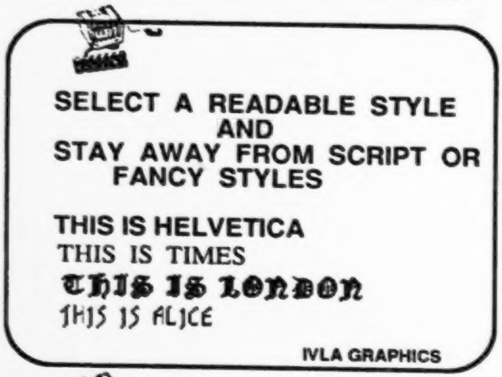


THIS IS A BOX
(OR SANS-SERIF)
TYPE LETTER
IT PROJECTS BETTER THAN
A
SERIF LETTER LIKE THIS

IVLA GRAPHICS

Guideline #7 **Stay away from fancy letters**

While Old English style letters look great on certificates or diplomas, this is not a style to use when developing instructional graphics. When using a computer, these lettering styles are referred to as fonts. I use a Macintosh and there are LOTS of fonts available. Quite frankly it takes a lot of willpower to stick to the box/bold letter. Please remember these are guidelines, sometimes it is desirable to use a different font for emphasis.



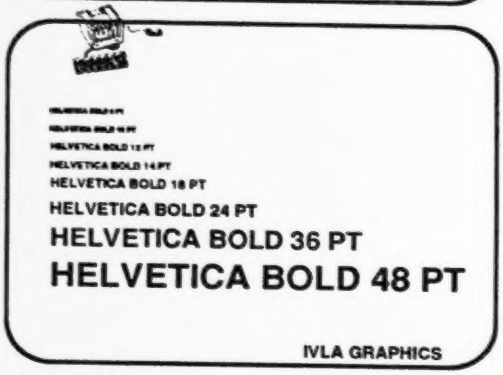
SELECT A READABLE STYLE
AND
STAY AWAY FROM SCRIPT OR
FANCY STYLES

THIS IS HELVETICA
THIS IS TIMES
THIS IS LONDON
THIS IS ALICE

IVLA GRAPHICS

Guideline #8 **A good style choice**

Ok, I hear you saying that a box style letter is best but which is the best box style letter? Helvetica appears to have all of the characteristics necessary to be the font of choice. Naturally the computer gives you the choice of size and style (plain or bold).

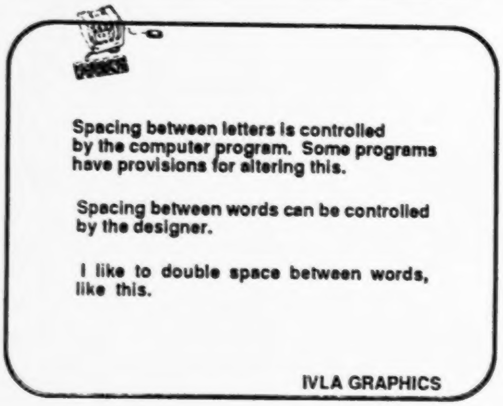


HELVETICA BOLD 12 PT
HELVETICA BOLD 14 PT
HELVETICA BOLD 18 PT
HELVETICA BOLD 24 PT
HELVETICA BOLD 36 PT
HELVETICA BOLD 48 PT

IVLA GRAPHICS

Guideline #9 **Spacing between words**

Spacing between letters and words is controlled by the computer and the computer program. Unfortunately the programs that provide for full justification are very expensive and memory intensive. Since this presentation deals with the use teachers can make of the computer, it is not likely that they would have access to a program of this type. I ignore attempts to space between letters and add spaces between words as needed. Double spacing between words, especially when using bold letters, seems to provide a better reflected image.



Spacing between letters is controlled by the computer program. Some programs have provisions for altering this.

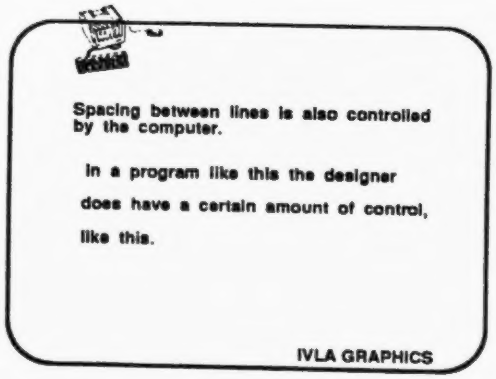
Spacing between words can be controlled by the designer.

I like to double space between words, like this.

IVLA GRAPHICS

Guideline #10 **Spacing between lines**

Spacing between lines is handled much like spacing between words. While the computer controls this spacing, the teacher or graphics designer can exert a certain degree of control by double spacing between lines. Here again it helps if the bold feature has been chosen.



Spacing between lines is also controlled by the computer.

In a program like this the designer

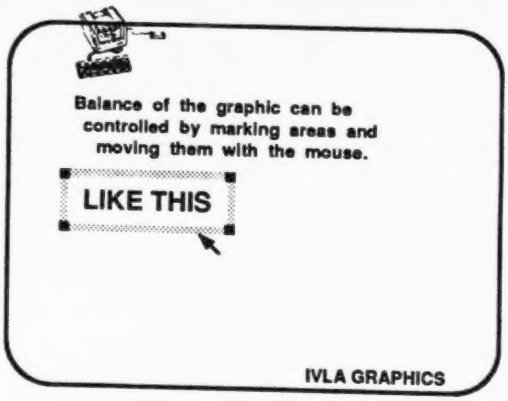
does have a certain amount of control,

like this.

IVLA GRAPHICS

Guideline #11 **Balance**

At one time, graphic balance, when creating an overhead transparency, was one of the most difficult chores. The original material would be developed and lots of cutting and pasting would take place. Graph paper and a light table were also desirable aids. The computer really simplifies this process. Written material can be automatically centered, aligned on the right, or aligned on the left. If the design requires further rearranging this can be accomplished by marking the text or object and "dragging" it to a new location. Of course, most programs allow you to view the completed project as it would appear on a transparency.



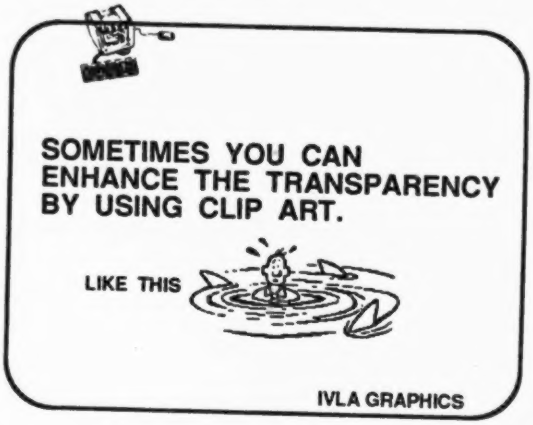
Balance of the graphic can be controlled by marking areas and moving them with the mouse.

LIKE THIS

IVLA GRAPHICS

Guideline #12 **Electronic clip art**

When using the computer to develop overhead transparencies, one of the nicest features, is the availability of clip art or digitized pictures. Generally electronic clip art is purchased on a disk and consists of line drawings which can be electronically copied and pasted as you develop your design. Some computers have a scrapbook feature which allow for storage and recall of selected graphics. Another of the marvels of using this feature is your ability to size and place the art at will.



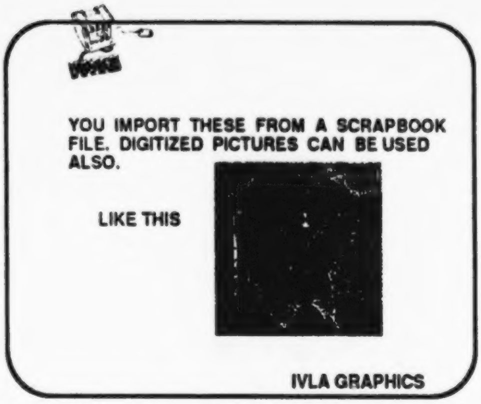
SOMETIMES YOU CAN ENHANCE THE TRANSPARENCY BY USING CLIP ART.

LIKE THIS

IVLA GRAPHICS

Guideline #13 **Digitized pictures**

Use of a peripheral device called a digitizer will allow the graphics designer to produce pictures using a video camera or optical scanning device. These pictures can be stored in the computer, altered if necessary and placed in the graphic being developed using the computer's copy and paste feature.



YOU IMPORT THESE FROM A SCRAPBOOK FILE. DIGITIZED PICTURES CAN BE USED ALSO.

LIKE THIS

IVLA GRAPHICS

In conclusion, the computer provides an easy, convenient, simple way for media specialists and teachers to develop instructional graphics such as overhead transparencies. Unfortunately it is this simplicity of operation which provides the opportunity for misuse. The same rules and guidelines which were developed for hand-produced graphics apply to compute -produced graphics, yet these rules have a way of being ignored as we play with this "gee whiz" technology. I implore you to exert your influence with your colleagues. While their enthusiast should be encouraged, they need to be made aware of the tried and true methods of instructional graphics design.

An old respected teacher of mine once told me, "just because the train has bells and whistles doesn't mean you have to pull the string." I find this admonition most appropriate now. Instructional graphics must have a purpose. Any extraneous information we place on the graphic will provide an avenue for altering that purpose. Instructional graphics are not an afterthought, they are integral to the instructional process. Careful planning and adherence to the principles of graphics design should be considered a requirement rather than a request.

This article was produced using a program called PageMaker. The figures were originally created as overhead transparency masters using a program called PowerPoint. For the purpose of this article the graphics were placed in an electronic scrapbook, reduced, positioned and pasted electronically. Naturally, in the figures, as a result of the reduction process, statements such as "THIS IS 36 PT" have also been scaled and do not reflect an accurate representation of a 36 pt letter.

Interpreting Three-Dimensional Computer-Generated Images -- A History of a Line of Research

John C. Belland, Gary B. Mayton, Marjorie A. Cambre, Susan Zavotka, Johnetta Goldthwaite, & Patti R. Baker
Ohio State University

Just as computers have speeded up and made more flexible the process of manipulating the written word, computer graphic systems have added power to the manipulation of images. Images can originate in a camera, be drawn with traditional artist's media or can be constructed in the computer using a mouse, light pen, keyboard commands or computer programs. Once the pictures are in digital form and are resident in the memory of the computer, an infinite array of transformations can be made on them. The possible transformations can range from the manipulation of viewing point and perspective through editing the objects in the picture, changing colors of the objects or the "light" or both, to the changing of the characteristics of each picture element (pixel). Pixel manipulation allows the manipulation of images so subtly that even the creators sometimes are unsure of just what has been done.

Most people are experiencing edited digital images every day without being aware of their source. Magazines, newspapers, and television all use digitally-constructed images to attract attention, to mesmerize, to editorialize, to inspire, to communicate and to sell. In order to understand more of the ways images affect viewers, a number of investigations have been conducted in The Ohio State University scholarly community. It is the purpose of this paper to provide a history of selected investigations, to sketch an initial intervention, to suggest an interim synthesis, and to delineate the immediate future for this line of inquiry.

Computer Imaging Technology

The process of producing and manipulating images using computers has evolved over the past twenty years. What began as little more than expensive "typewriter art," *i. e.*, the use of rows of printed characters to form the shapes of the objects to be imaged, now includes printed graphics with a resolution of 300-2000 pixels per inch, on-screen images in black and white or color with resolution similar to that of the printed graphics, and videotape recorded directly from the computer memory.

There is a trade-off between the size and speed of the computer and the resolution of still computer pictures. The size and speed of the computer also determines whether the graphics can be animated in real time or whether they will have to be stored on videotape for playback later. Thus while it is possible in theory to produce complex images and animations on almost any computer, very fast computers with lots of memory are required if the images are to be rendered in a reasonable time. Even present supercomputers are taxed to render complex animations in real time.

Computer graphics can be developed as if the artist were drawing on paper or canvass. In other words, the computer artist can process the visual image in her/his mind and translate the result of that processing to the computer. These images can be line drawings or shaded, colored painting-like images. They can represent two-dimensional objects all on one plane, orthographic views of three dimensional objects, or perspective views of three-dimensional scenes. These images can be experienced singly as in a slide or print or can be combined into animation sequences.

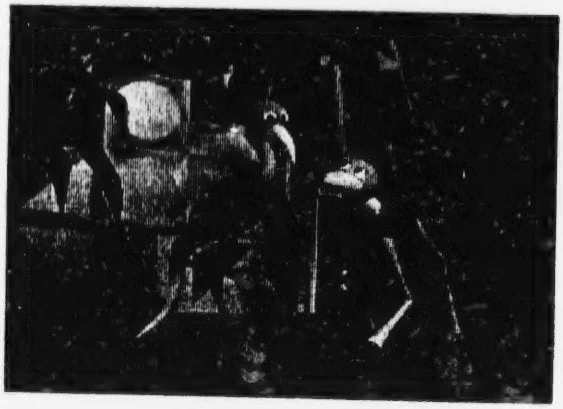
Computer graphics can also be developed out of sets of data which represent all the surface characteristics of three-dimensional objects. Then these objects can be combined in an imaginary 3-space in the computer. "Lights" can be directed at the "objects" and an eyepoint can be chosen. The computer then calculates what the image would look like if projected on a flat surface (the CRT screen or the printed page). Thus three-dimensional computer graphics are images which have been constructed from a great deal of data and are rendered by computation. Laws of physics can be built into the algorithms so that when a light is moved twice the distance from an object, its illumination will have one-fourth the intensity (the inverse square law). The effects of gravity, laws of acceleration, elasticity, transparency/opacity, and many others have been programmed into the picture-making calculations. Of course, 3-dimensional computer graphics can also be sequenced into animations. Interestingly, once the data sets for all the objects in a 3-dimensional image have been constructed, it is relatively easy to create animated sequences by specifying the path through which each object, eyepoint or light source will move.

At The Ohio State University, Charles Csuri organized what was then called the Computer Graphics Research Group (CGRG) approximately 15 years ago to focus on the development of 3-D computer graphics and animation. Faculty and graduate students from disciplines in computer science, engineering and art worked together to configure hardware and write software which would increase the possibilities for the generation and manipulation of these images. This early work was conducted on a large minicomputer which became essentially a single user machine while images were being displayed and animation sequences photographed onto 16mm film. As computer technology advanced, CGRG was able to implement its software on smaller and smaller systems. At the present time, this group (now called the Advanced Computing Center for the Arts and Design) has implemented very sophisticated graphics and animation on Sun Workstations and is working on a variety of display systems linked to a Cray supercomputer.

Faculty and graduate students from a variety of departments have been able to benefit from the research of CCRG and ACCAD. For example, the College of Education has worked closely with Csuri and center associate director Tom Linehan on research projects to benefit deaf learners, preschool children, elementary students learning mathematics, and college students learning design skills. The College purchased a large (for the time) microcomputer (DEC PDP 11/23+) which was housed with the graphics research group for the training of College of Education students and the development of research animations. ACCAD has also continued to make space in their well-filled courses so that Education graduate students can be trained in three dimensional graphics technology.

Attributes of Animated Graphics

A great deal of computer-generated 3-D graphics animation has tended toward the visually spectacular and has been oriented to attention getting for advertising products and services. Probably the first large-scale use of such images was in connection with the television broadcasts of sports spectaculars such as the Superbowl. Such images are often designed to fool the eye as something which looks like a flat corporate logo suddenly is seen to be a 3-D object which metamorphoses into some other powerful visual symbol. Other images are manipulated to do that which is visually impossible in the real world. Others use color, light, texture, and point-of-view taken to exaggerated extremes in order to arrest the viewer's attention. None of these com-



puter generated animations do anything which couldn't have been imagined or produced using traditional cell animation, but they have been produced in much shorter time at much lower cost by using the computer technology.

Other computer animations have been developed to allow people to observe phenomena which have been impossible to observe previously. Physical laws and theories have been programmed into the computer and then an animation is constructed which simulates the visual manifestation of phenomena which are too fast or too slow, too large or too small, too dangerous or too complex to be experienced by the unaided eye or through earlier technologies like time-lapse photography. This sort of animation usually requires a supercomputer and is advancing knowledge in aeronautics, medicine, combustion engineering and other fields.

Research

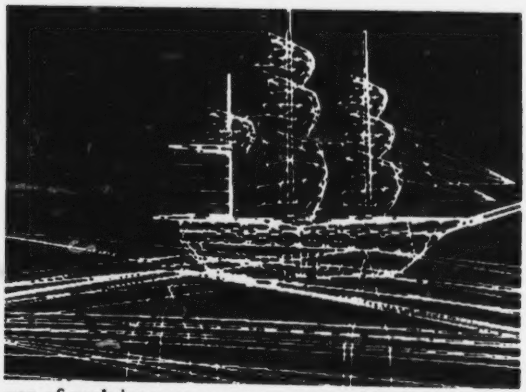
For the past decade, faculty and graduate students in the program of Instructional Design and Technology as well as students in the Department of Industrial Design and Systems Engineering have conducted studies which have explored how learners interpret pictures displayed on a flat screen. These studies have focused on: the extent to which a learner interprets the flat display as containing 3-D information, the relationship of field dependence-field independence (FI/FD) to the interpretation of "wire frame" and solid-modeled images, the comprehension of mathematical and motor concepts from forms of visual presentation, and the training of learners in visualization for orthographic drawing and for map symbol recognition. Some of these studies are summarized and discussed below.

Interpreting 3-D information in a 2-D display. Powell (1980) followed up on Kosslyn's (1973, 1975, 1978) and Pinker's (1979) work to measure the extent to which a learner viewed a 2-D representation of a 3-D scene as containing 3-D information. These studies all used a technique in which the scanning times as a viewers eye moved from object to object in the pictures were correlated with the actual interobject distances in the referent 3-D scene and the distances on the screen in the photographic representation of the scene. All the studies indicated that learners do preserve 3-D information in the 2-D representation of the referent scene. However, Powell's study determined that learners who were scanners (in a focuser/scanner continuum) performed scans with much higher correlations with 3-D distance than the scans performed by learners who were focusers. Powell cautions that since the amount of 3-D information is reduced (especially among the focuser learners) when scenes are viewed in flat projection (as in a slide or computer graphic) one should not substitute slide or screen viewing for the direct observation of a 3-D world. However, it appeared that screen images could extend a learner's experience with 3-D phenomena.

While the experimental procedures developed by Kosslyn and Pinker and extended by Powell probably seem strange to educators, the dramatically high correlations of 3-D distance to scanning time (.98 for scanners in Powell's study) and substantially lower correlations of 2-D distance (Powell found .44) suggests that this is a strong effect. In addition, these researchers raised questions and issues related to the contrast between the perceptual part of the experimental tasks and the mental imagery part. Powell found that for focusers, the mental image scans which resulted from an image stimulated by viewing a photographic slide tended to correlate highly with 2-D distance (r=.94).

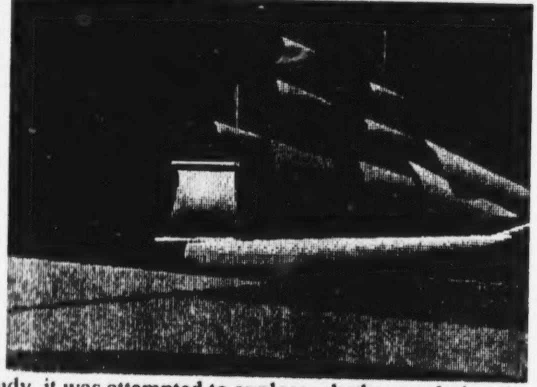
These studies provided a basis for continuing investigations into the cognitive effects of experiencing representations of 3-D on a flat screen. It seemed reasonable that at least for some learners, spatial imagery was created by viewing screen displays and that questions could be explored as to whether learners could be taught to get more 3-D information from such images and whether strategies could be developed to use the dramatic and exciting emergent technology of computer graphics and animation in a rational manner to effect spatial learning.

Wireframe vs. solid modeling. Most computer graphic systems yield less than photographic quality images. The number of pixels has been limited to a range of 6 to 72 per inch (photographs yield over 1000 pixels per inch). The number of shades of grey has been limited in contrast to the continuous shading possible in a photograph, and the number of colors has been restricted to less than are available to children with a box of crayons. Even very expensive computer graphics systems before 1985 could rarely render more than 16,000 colors. In general, the computer-graphics displays available to educators yielded crude, unrealistic images. When the images were constructed out of 3-D data, they were usually rendered as 3-D line drawings commonly called "wire frame" drawings since they looked like a model of the object constructed of intersecting wires. These wire frame images seemed almost like magic to visually-oriented people.



They could be manipulated on the computer screen just as if one were holding an object and was rotating or repositioning it in her/his hand. Other people, however, found these images perplexing. While viewing wire frame images, they would ask, "Which is the front?" or they would say, "I can't make that object stay the same. It seems to flip-flop between two different objects." In a pilot study for one of the studies reported below, two subjects viewing wire frame images became hostile. These adult learners said that they did not want to look at such pictures because they couldn't figure out what they were looking at. Such experiences suggested exploring how learners interpreted wire frame or solid modeled imagery and investigating whether learners could be taught to "read" wire frame images when the use of such images was common and important—*e. g.*, reading blueprints (orthographic drawings and perspectives).

Cambre, Taylor & Belland (1983) and Cambre, Baker & Belland (1984) conducted a series of studies which explored the teaching of the mathematical rule: If one doubles the length of the edge of a cube, he/she multiplies its volume by eight. The original impetus for selecting this rule came from a "cell" animation produced for Children's Television workshop which presented a visualization of this rule combined with live-action shots of a hand picking up the eight small cubes arrayed near the large cube and pouring the powder from each little cube into the big one. The powder filling the eight small cubes filled the one large cube. Researchers for Children's Television Workshop (CTW) had conducted an evaluation of this animation and found that it was ineffective. Using a computer animation system at the Computer Graphics Research Group (CGRG), Baker developed an animation which paralleled the "cell" part of the CTW animation and then also rendered the same sequence in reverse (replacing the hand and the powder-fulled cubes). In simplified terms, a cube appeared. Extensions were added to double the length, width and depth of the cube and the cube was shown "growing" from the original to the new size. Then the cube was partitioned into the smaller cubes and each small cube was removed from the large cube and arrayed in front of it. This sequence was exactly the same as the sequence in the first half of the CTW animation. The animation was rendered in wire frame and in solid modeled form resulting in three treatments of equal length: the CTW animation, the wire frame computer animation, and the solid modeled computer animation. It was found that the solid modeled computer animation resulted in more subjects recognizing the rule. Field independent learners could also perform well after viewing the wire frame computer animation but field dependent learners could not. The CTW animation yielded results lower than that of the two computer generated animations. In a subsequent study, it was attempted to explore whether rendering the cubes as transparent, as if they were crystals or blocks of colored ice, would provide an even more powerful stimulus for learning. It was reasoned that the transparent objects would permit the learner to see what was behind the front layer of cubes (as she/he could with the wireframe) and yet not be confused by the wireframe imagery. The results yielded an interaction between the treatments and FI/FD. FI learners performed best with the transparent cubes and worst with the solid modeled version. FD learners performed just the opposite, best with the solid modeled and worst with the transparent. It is believed at this time that the transparent animation presented too much information for the FD learners to process.



Zavotka (1987 & 1988) had observed that students who were learning to be designers of 3-D spaces such as kitchens seemed to have difficulty interpreting plans, elevations and perspective drawings. This problem occurred both when learners tried to make drawings or interpret the drawings of already constructed spaces or when they tried to visualize how a plan which had been drawn would look when built. Since plans and elevations are 2-D line drawings and perspectives are wire frame images, she believed that computer animation could enable the investigation of the problem. She developed a series of animations which ran three scenes through the same sequence of movements. These movements involved changing the "eye point" from a normal eye position to a position directly to the side of the scene to represent an elevation or directly overhead to represent a plan. Then she animated the removal of all perspective. Thus one first viewed an object in a very normal way. Second, one viewed the object from the eyepoint appropriate for the rendering of a plan or elevation. Third one saw all 3-D information gradually removed so that what remained on the screen had the form of a plan or elevation. The three objects consisted of a simple house exterior, a stairway and interior door, and a "c" shaped kitchen. These animations were rendered in wire frame and in solid modeling. Zavotka's design presented the animations to the learners in different sequences—some learners received the wireframe animations first and the others received the solid modeled animations first. In general, she found that learners who experienced the wire frame animations first exhibited lower scores on a test of mental rotations than either the other experimental group or the control group (which of course saw none of the animations). The learners who saw the solid modeled animations first and then saw the parallel wireframe animations learned the skill of interpreting plans, elevations and perspective drawings. Thus by providing the intermediate step of viewing the solid modeled animations which transformed 3-D scenes into plans and elevations, learners were able to interpret the wireframes. Such a visual progression from perceiving the real world through perceiving high resolution solid modeled representations of that real world and then to the abstraction of the line drawing and wire frame would seem to be a reasonable example of modeling a visual cognitive process for the learner, what Salomon (1979) calls supplantation.

Zavotka (1988) then studied whether there would be a differential effect for learners of different ability levels as Salomon predicted. She confirmed this effect. Low ability or novice learners are most benefitted by the visual modeling. Higher ability learners who rely most heavily on other symbol systems such as the verbal may experience interference and confusion. Higher ability students who can use a variety of modes and symbol systems or whose preferred symbol system matches the visual modeling used in the instruction also benefit well.

Hozaki (1987) studied learning the folding of an origami figure using realistic visuals, line drawings and verbal instructions. Origami books usually present techniques using line drawings and many people report difficulty in using these drawings as stimuli for learning how to construct a figure. Hozaki used computer-controlled video to provide his realistic images rather than computer animation so the visual stimulus provided to the learner is the actual folding of the origami object from the subjective viewpoint shown on a CRT. The line drawings were simple computer graphics also presented on the CRT. Performance of actually folding the origami object was as well as interpretation of line drawings of origami folding was measured. Hozaki found that the learners who viewed the realistic visuals performed best on both the folding task and the other measures. These findings are in harmony with Zavotka (1985) and Cambre, *et al. (1983)*, since he demonstrated the difficulty learners have in interpreting wireframe images. He also made some conjectures about cultural influences on visual-spatial thinking which need further investigation.

Teachers. Baker (1986) addressed the need to anticipate the curricular impact and instructional benefits of computer graphics and animations at the classroom level. Since teachers are generally sensitive to the effects of instructional practice and materials upon their students, Baker sought elementary and junior high teachers' reactions to state of the art 3-D computer generated animations. Through: 1. a series of interviews, 2. several viewings of various commercial applications of computer animations, and 3. a final Q-sort for data triangulation, she found that the teachers were, for the most part, excited about the instructional applications and curricular implications of 3-D computer animation.

In addition to liking the stimulation provided by color and movement, the teachers identified computer animation as an effective way to demonstrate dynamic systems. Teachers saw in these dynamic representations a way to portray concepts such as cause and effect, concurrent operations and the relationship of a part to its whole. Two predictors of the teachers' reactions to the animations were grade-level taught and subject expertise. Grade level differences elicited concerns with the form of the graphics. Complexity and speed of movement were considered as beneficial attention getting properties for junior high school learners but were considered to be too distracting and confusing for elementary students by their teachers. Subject expertise interacted with grade level in reactions to the content of the animations. For instance, an internal award winning cartoon-like animation was considered "cute" by the middle school teachers but was perceived as a potentially important language development activity by the elementary language arts teachers because of the emphasis on changes in perspective in the animation.

The teachers were excited about the potential in computer animation for teaching about abstract concepts and for encouraging higher cognitive processing. The results of the study also suggest that utilization of computer generated animation would be enhanced by its manner of delivery—*i. e.*, videocassettes and broadcast television were considered viable and available ways to include such animations in classroom lessons.

Intervention

Since it seems apparent that spatial information is interpreted by learners when they view representations of 3-D on a flat screen, and since learners seem to learn more when they experience solid modeled imagery representing 3-D objects, and since learners seem to be able to learn to interpret 3-D line drawings (wire frame) by first being exposed to the solid modeled images, it seemed reasonable to explore the introduction of solid modeled 3-D computer images in a classroom setting. A fifth grade classroom was selected because these intermediate grade learners are at a critical stage in their intellectual development. They have developed substantial verbal skills, they have learned most of the traditional basics and they are setting learning patterns which will result in selections among curricular offerings in middle school, high school and beyond. In the fifth-grade classroom, girls and boys manifest similar levels of both verbal and visual skill. The boys have finally begun to catch up with the girls on the verbal and the girls have not yet fallen behind the boys on the visual.

Four Macintosh SE computers were installed on October 13, 1988, in a fifth-grade classroom in inner-city Columbus. This classroom is multiracial and multiethnic with a number of students from families of low socioeconomic status.

The teacher in this classroom is a Masters' graduate of the computer applications strand of the program in Instructional Design and Technology at The Ohio State University. She volunteered to collaborate with OSU faculty not only to use these computers to provide visual spatial experience and learning but also to integrate the Macintosh technology into all other appropriate areas of the fifth-grade curriculum. The school principal and district technology supervisor have given strong support for this effort and it is intended to involve the parents of the students. The equipment was funded by the Columbus Public Schools from proposals submitted in a district-wide competition and was the only elementary-level project funded.

Students will be measured on a variety of visual abilities including mental rotation, mental paper folding, spatial relationships, field dependence/field independence, focusing/scanning. Measures of verbal and mathematical ability are available from the standardized testing program of the District.

Processes will be measured by participant observers from OSU and by the observations of the teacher. Results will be measured by repeating the visual-spatial measures. No formal hypotheses were generated since this is an intervention rather than a study. The purposes for the intervention are:

- To explore whether solid modeled 3-D animations possible with Macintosh technology may improve performance on measures of spatial ability
- To estimate the usefulness of the Macintosh interface for providing friendly control of the computer by fifth-grade students
- To refine ideas for instructional animations or animation generating activities which would be interesting to and seem beneficial for fifth-grade learners
- To develop a model for cooperation between teachers and university researchers in the introduction of technology
- To encourage examination of the importance and potential contribution of visual thinking and mental imagery in the school curriculum
- To explore whether early intervention can enable girls to maintain visual parity with boys.

Conclusion

In the last eight years, substantial progress has been made in computer generation of images. The power of these techniques and the rapidly decreasing cost of the hardware has made it possible to study aspects of visual thinking and the impact of image stimuli on mental image processing.

Dwyer (1978) has established that in 2-D visualization the line drawing is the most effective stimulus for learning. In 3-D visualization, this principle does not seem to apply. Wire frame rendering, the 3-D equivalent to line drawing has been found to be difficult for learners to interpret. Other studies have demonstrated that learners can be trained to interpret wire frame images and that they can learn to interrelate 2-D and 3-D renderings of the same objects or scenes.

While there is an enormous amount of research yet to be done, it also seemed reasonable to begin intervention in a regular classroom so that some of the research findings could be translated into instructional experiences to benefit learners.

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Visual Literacy: A Factor of Text Design and Reading Instruction

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Gaining information from printed material or during instruction which consistently portrays the intended concept is an important goal for student instruction. The contention of the research cited in this paper is to illustrate how text design, format, and instructional presentation, impacts on the literacy level of the learner. Specifically, literacy is defined by this author as; the ability of the learner to conceptually form a schematic representation which concisely illustrates that presented by the instructor or with in printed text. Several areas will be briefly explored: reading, reading instruction, and text design. Keep-in-mind that all of these areas influence how information is constructed by the reader to gain comprehension.

Reading

Reading is an interactive process between the reader and text (Just M.A., & Carpenter, P.A,1987). This interaction can lead to gaining comprehension or the lack to gain comprehension. It is also influenced by a number of factors such as : prior knowledge; schema representation (formation); text design; and reading (learning) strategies initiated by the reader to process familiar or unfamiliar text. The method or approach taken by the reader to comprehend text is largely influenced by the comprehension skills of the reader (high or low level reader). High-level readers continuously interact with the text on a number of levels leading to better recall and transfer of learning. The high level reader may impose a variety of strategies on the text content to gain a broader comprehension by systematically relating concepts internally and externally. The number of strategies possessed by the high level reader increases their ability to comprehend and learn from text. Low-level readers are text dependent meaning, they have limited resources or strategies accessible to interact with the concepts presented in the text beyond a visual level. Instructional design principles to enhance reading instruction and text design need to consider this interactive process; so that text strategies are generalized by the student given a particular text. These principles therefore, should enhance transfer and retention of text material as indicated by the reader's ability, to implement a strategy when presented with an unfamiliar text.

Reading Instruction

Instructional methods employed by the teacher in a classroom significantly impacts the approach taken by the learner to comprehend text. Comprehension as previously noted is an interactive and assimilative process between the learner and text. It is depended upon the strategies and /or cues used by the learner to gain meaning. The high-level comprehension reader employs a variety of strategies given the difficulty level or ease of the material, familiarity with text format (organization), constraints of the task and self-directed goals.

Beth Davey states in her article (1988) "How Do Classroom Teachers Use Their Textbooks?" that, teacher's use of textbooks can signal their relative importance for content learning. She further notes, teacher differences in text presentation and usage by elementary and secondary teachers. Her results indicated that secondary school teachers should attend to:

1.) grouping strategies for cooperative learning from text
2.) overview text selections prior to assignments
3.) the desirability of using a variety of information sources
4.) the importance of ample vocabulary development prior to and following textbook activities
5.) specific strategies for selective reading and learning, such as student summarizing ,cueing important information, and self-questioning. (Davey,B.,p.344)

Instructional methods such as those identified by Davey for secondary teachers are reasonable solutions to a frequently neglected situation. However, reading instruction should not be limited here but require that we look at the text and the reader in order to decide what strategy needs to be taken to increase greater comprehension. Instructional strategies assist the learner or reader, to learn, how to learn or read, independently. Realizing the variety of text formats and content areas that an average student must come into contact with it is best to introduce strategies which can be generalize when possible.

Strategies for analyzing textual information fall into basically two major groups: analyzing textual formats (patterns), and what will be described as conceptualization. Cognitive psychology theory has acquainted us with information significant to determine the difference between high level, and low level readers. It is important to keep in mind top-down and bottom-up processing. It is contended that this disparity between levels can be due to knowledge of textual format patterns. To help students do this teachers need to prepare a content analysis of each chapter, organizing, and sorting the material to establish areas of priority (Strahan, D., Herlihy, J., 1985). Namely the learners familiarity with the texts textual format can lead to pattern recognition.

Pattern recognition is an important strategy for text-depended learners (low-level readers) to develop. Familiarly with pattern formats limits the demands made on the processing capability of the student. The learner is then able to use the pattern as a guide or conceptual map. Information or meaning gain from text can then be organized not only meaningfully but, more precisely, limiting imprecise elaborations from being made. By providing the learner with strategies to recognize text patterns such as: temporal order (time order), attribution (list structure), adversative (compare-contrast), covariance (cause-effect), and response (problem-solution) (Horowitz,R. 1985). The learner is able to develop inferring skills for example, by using schematic patterns base upon the information in long term memory and that of working memory to gain comprehension. Therefore, information can be organized into patterns on two levels: textually and schematically. It is this match between patterns that educators need to be aware of and strive for in there educational programs.

Conceptualization is the second major strategy identified to analyze textual information. Conceptualization is also the largest of the two strategies identified it encompasses the learners ability to gain meaning from text either by inferring (forming hypothesis), summarizing, forming visual (problem) solving schema, developing schematic or concept maps (content analysis), and checking metacognitions to determine comprehension. These terms will not be elaborated upon here but, are important strategies for learners to gain comprehension.

Text Design

Text structural format and its story grammar need to be designed systematically. Mengel's research (1986), revealed that text materials developed following specific instructional design theories (R.Gagne,1977), significantly improves the readers ability to comprehend text, and to meet course objectives. However, development should not stop here it is important to keep in mind the conceptual ability of the learner to learn from text. Design implications of text material should allow for the readers schema to: assimilate textual information, facilitate selective allocation of attention, enable inferential elaboration, allow for orderly searches of memory, facilitate editing and summarizing, and permit inferential reconstruction (Anderson, R.C. 1984). The reader will then be able to form schema's by interrelating concepts based on the format of the textual pattern, story grammar (content), and prior knowledge.

Text structural designs can be broken into two groups: textual patterns previously noted, and text design components (headings,text signal-cues, sentence structure,story content/grammar). For clarification the text design components will be briefly described as follows:

1.) Headings

The learner is guided through the reading passage by following headings. Headings when used alone fail to improve learning of prosed material. Headings used following instructions act as processing aids which facilitate test performance (Brooks, Dansereau,Spurlin, and Holly,1983). The learner benefits from text processing by using headings. Instruction can benefit the reader by illustrating how to use headings to process and organize information in the text by categorizing and grouping concepts. Headings like advance organizers can help the learner organize information cognitively for better retention, recall, and transfer of knowledge.

2.) Text Signal-Cues

Britton, Glynn, Meyer and Pentand (1982), analyzed text structure to determine how the surface structure places demands on the readers cognitive processing capacity. Special words and phrases (bold typed, highlighted, italicized..) can be used to signal learners as to which ideas are most important. The signals can help learners to construct an internal representation of the texts format. Internal representations are associations made by the student between elements of the text or chapter(s). If these signals are not provided, then learners must infer the relations necessary to construct the internal representation.

3.) Sentence Structure

Sentence length and complexity can influence cognitive processing. Sentences containing several propositions demand higher levels of processing than simpler ones (Gagne,E. 1985; Britton, et. al.1982). This can be reduced if the reader is familiar with the texts-story grammar, and if the passages allow for redundancy on the lexical, syntactical, and semantic level (Smith, F.,1986). Cognitive capacity specifically, short term memory is guided in the reading process by the cognitive guidance system. This system works with the peripheral guidance system to regulate text processing from a conceptual and visual perspective. If the reader encounters a sentence which is unfamiliar to him, because of the presentation of a number of propositions not encountered before, comprehension can be lost. The reader will probably resort to rereading the sentence trying to form simpler propositions to gain cognitive processing. Britton et.al., concluded that syntactically simplified text are probably responsible for reducing cognitive capacity use. Judgments should be made to determine if sentence length will conflict with cognitive capacity or comprehension.

4.) Story Grammar/Content

Story grammar provides a framework which identifies variables (constituents) of the story. Story grammars specify a hierarchal structure indicating the composition of a story in terms of constituents like settings, and episodes (Just,M.A., et.al,1987; Weaver, P.A., Dickenson, D.K., 1982) Story content whether it's narrative or descriptive, influences how the story framework (style, or grammar), and schema are formed by the learner. If the text's content is unfamiliar to the reader due to prior knowledge or lack of familiarity with story style (narrative, descriptive) this will result in slower reading, comprehension, poor inferring, and assessment performance (Just & Carpenter, 1987).

Text structural design components significantly influence how the reader learns to process and organize information. Story grammars reflect one way stories are processed during comprehension and one level of their representation in memory (Weaver, et. al.1982). The reader must determine the relations among the events, objects, and facts that are described by the text and construct a representation that integrates the information (Just,M.A.,et.al.1987). However, other recent work suggests that world knowledge in the form of scripts or frames, creates expectations which in turn guides text processing (Weaver, et. al.,1982). The reader must not only possess a level of "world knowledge" but, be able to relate it to the idea's presented by the text. This will result in greater comprehension of text material (literacy), because of goals set and managed by the reader, to gain meaning from text. Prior knowledge dictates what goals are set, and monitored by the reader for comprehension.

Research findings, in general, indicate that readers exposed to various text structural design formats can benefit substantially from them if, prior knowledge is also used to manipulate and integrate ideas. One essential aspect of text comprehension is the ability to concentrate on important or thematically relevant material to the exclusion of nonessential material (McConaughy,1985).

Conclusion

Reading comprehension is an interactive process; it is this interaction between learner and text that designers/instructors need to be aware of. Text design or format can enhance or limit the literacy level of the student. It is important to analyze the text's design by each chapter to determine the overall organization, macrostructure, or microstructure of discourse. (Kintsch, VanDijk, 1978) Elements of text design should consist of : grammar style, an efficient use of sequential and hierarchic ordering, variation of type style and format to identify or discriminate among concepts, headings, graphics or pictures as needed. Textual organization can be used by the reader to gain comprehension by presenting clearly organized patterns. These patterns can assist the learner to form propositions, or concept maps to interrelate concepts on all levels.

Chapters which provide overviews related to the text chapters content at the beginning act as advance organizers, so that conceptual formats can be sketched or mapped. Text questions, also assist the learner organize information externally by forming schematic representations of the main ideas in the chapter.

Reading literacy is very much a factor of efficient text design, format and instruction. It clearly illustrates the importance of presenting information to the learner in such a way, that, schematic patterns can be made complementary to textual concepts (or textual patterns). Leading to the development of precise elaborations of concepts, inferring, summarizing, and problem solving schema.

Instruction in the area of reading should prepare the reader to develop strategies to analyze, and organize, text material internally and externally. Reader's who are able to develop such strategies gain better comprehension of text material. Reading is a self-mangagement process guided by the reader who monitors comprehension. This process can be goal directed and managed, by the student through effective instruction and text design.

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Designing Visuals to Complement the Message

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With current technology and limited computer expertise, anyone can create sophisticated visuals for written reports. In one software package, users can choose from a palette of 330 colors. With other packages, they can add prepared artwork in the margins, experiment with three-dimensional designs, or create perspective drawings. However, this advanced technology and ease of use will not necessarily improve the quality of visualizations. According to Blake Ives (1982), the effectiveness of visualizations may actually decrease since people with no training in visual design will now be creating graphics. These people may become so caught up in the technology that they lose sight of the message that these visuals should deliver. Unless the visualization and the words these visuals accompany deliver the same message, the audience may become confused and miss the writer's point. In written reports, visuals and words should complement each other, not compete with each other.

The art of creating complementary visuals and words is based on general rhetorical principles concerning purpose, situation, and audience and an understanding of the ways in which people interpret visual messages. Knowing that certain kinds of data work better with certain graphic forms helps to narrow graphic choices. With a specific rhetorical purpose in mind, writers can further refine their choice of graphic format to reinforce thematic concepts visually. An understanding of the ways in which audiences interpret and use visuals also helps in determining the most effective way to introduce and position visuals in the text. The remainder of this paper will discuss these concepts in greater detail.

Scope and Limitations

Many of the "rules" currently accepted in visual design are based on long term use rather than on empirical research. However, a large body of research does exist. Although this paper does cite relevant research, discussion of this research is made difficult by the number and variety of visuals. For example, many studies of visual perception are based either on simple images without meaning such as a circle or triangle or on complex pictures embodying a great deal of detail. Since it is quite probable that viewers perceive each of these forms differently, it is difficult to apply findings from one study to visuals in general. In addition, the terminology used across studies is often ambiguous. Some researchers will differentiate between charts and graphs; others will group them. To avoid compounding these difficulties, this paper will use the same terminology used by the original author in discussing research wherever possible.

This paper also focuses on the visuals used in most business reporting for data analysis and decision making. It does not consider presentation graphics used in persuasive oral presentations, design graphics used in engineering functions or scheduling graphics such as PERT charts. Nor does it consider visuals used primarily to provide drama such as those found in weekly news magazines.

The Impact of Visuals

Pictures create a greater impact than words alone. Early studies on visual perception, such as those conducted by Ralph Norman Haber (1970) at the University of Rochester in the 1960's, suggested that people retain pictures longer than words because pictures are stored whole in the long-term memory. Words, on the other hand, are translated into concepts before being stored, and some details become lost in the process. More recent studies, however, suggest that pictures, like words, do undergo processing before being stored in the long-term memory. Because pictures are richer in details, however, they are stored with more retrieval cues. As a result, people can retrieve pictures more readily and more accurately from memory than they can retrieve concepts expressed in words alone. For example, Terry Childers, Susan Heckler, and Michael Houston (1986) found that subjects recalled more elements of the pictorial portion of an advertisment and remembered more of the central messages conveyed through the pictures than they could from accompanying copy.

Although the methods by which pictures are processed and stored are still conjecture, one thing remains quite clear: pictures leave a vivid impression on the viewer. For this reason alone, visuals should be used only to present major points. If the writer illustrates every bit of quantitative data in a report, members of the audience will not know where to focus their attention. Words and illustrations will provide competing messages.

Importance of Rhetorical Purpose and Audience Task

Once the need for an illustration has been determined, the writer can use rhetorical purpose to identify the most compatible graphic format. In studies conducted with junior high school students in the 1920's, John Washburne (1927) found that certain types of graphic designs serve specific purposes.

1. Use tables when recall of specific amounts is important. Tables can present precise amounts.

2. Use line charts to compare trends or points of change.

3. Use column and bar charts to compare amounts.

Drawing on these findings and other research on visual cognition, most designers of graphic aids also accept the following assumptions.

1. Use surface charts to compare both amounts and trends when the trend is more important than the amount. Surface charts are not overly effective when the layers are highly irregular and can not be used when the layers intersect.

2. Use pie charts to show how 100% of something is divided. (Current research suggests, however, that divided bar charts may show divisions more accurately than pie charts since people can judge changes in line length more accurately than changes in area

[Cleveland and McGill, 1984].)

3. Use maps to locate items in space.

4. Use photographs to show how something actually looks. Photographs, of course, will show only exposed parts and may include extraneous detail not important to the discussion.

5. Use drawings to show the way in which pieces fit together or the inner workings of a mechanism or when instant recognition of an object is important. (Ryan and Schwartz found that subjects had to look at a photograph longer than at a cartoon or outline drawing before they could correctly identify an object [Haber and Hershenson, 1980].)

6. Use flow charts to show a hierarchy or the movement of a product or process.

7. Use a scattergraph to illustrate causality and relationships between trends.

The writer's purpose embraces not only the rhetorical purpose, the concept the writer wishes to present, but also audience's task, the way in which audiences will use this information. For example, a drawing in a procedures manual can be simplified if the audience needs to know how a device works only so they can use it more effectively. If the audience must service the equipment, however, they will need more detailed and exact drawings. A pie chart showing the allocation of the department's budget may serve the needs of the executive vice-president, who needs only an overview. However, the head of accounting will need more precise figures to incorporate the department's budget into the overall budget. This person needs a table showing precise amounts.

The importance of audience's task is shown in the many studies attempting to identify whether graphical or tabular presentations work more effectively in decision-making. In their review of the empirical studies testing the effectiveness of tables and graphs in decision-making, Gary W. Dickson, Gerardine De Sanctis, and D. J. Mc Bride (1986) identify four studies that found graphs superior to tables and six studies that found tables superior to graphs. Dickson, De Sanctis, and Mc Bride attribute the conflicting findings to differences in the tasks the subjects were required to complete to make their decisions. To confirm their hypothesis that task determined whether a table or a graph would work more effectively, these researchers conducted three experiments which varied task content, task complexity, and the degree of task structure. They found tables superior to graphs in tasks where accurate interpretation of values were important, especially when the user had had experience in using tables. Graphs outperformed tables when users had to work with large amounts of data showing time dependent patterns.

In another study, Narayan S. Umanath and Richard W. Scamell (1988) tested the effectiveness of both graphs and tables in on-the-spot decision making. They hypothesized that the ability to recall information would facilitate on-the-spot decisions. To test this hypothesis, the researchers gave subjects information either in the form of tables or bar charts and line charts (the two graphic forms used most frequently in business reports). Forty-eight hours later, the subjects were asked questions about directional order, pattern recall, and specific facts. Umanath and Scamell found that the ability to recall information did fade under all conditions over a 48-hour period, but that graphs allowed for better directional and pattern recall. The format was negligible in the recall of specific facts. These researchers also observed that 56% of the subjects receiving tables scribbled in the margins, noting increases or decreases or actually graphing movement. Only 20% of the subjects receiving a graph made any notations in the margins. The findings in both these studies parallel those of Washburne in 1927.

That the form of information display can affect the reader's ability to use that information is evident from a study by Eric J. Johnson, John W. Payne, and James R. Bettman (1988). These researchers asked subjects to make decisions on the basis of probabilities expressed either as fractions or percents. All figures presented the same data, but some presentations were more difficult to read (for example, 9/10, 81/90, 513/570, and .9). They found that the format of the information display encourages or discourages certain forms of information processing. Subjects do not transform data to fit strategies for decision making; they alter their strategies to fit the data display. Johnson, Payne, and Bettman recommend using what they call "passive decision supports," displays which encourage the use of proper strategies. Patricia Wright and Fraser Reid (1973) reached similar conclusions in their comparisons of narratives, lists, flowcharts or algorithms, and tables. Although all formats except narratives worked well in isolating specific bits of information, algorithms produced the fewest errors in more complex problems requiring the user to interpret data. Wright and Reid suggest that the algorithm helps users to structure problems and recommend its use if the problem to be resolved is embedded in miscellaneous information. Both studies suggest, therefore, that the visual arrangement of a graphic must encourage the reader to make the kinds of comparisons that highlight the writer's meaning.

Holistic Viewing and Simplicity of Design

Subtle changes in design can create problems for readers because they tend to view a graphic holistically before they examine individual segments. According to the theories of gestalt psychologists, the overall visual design creates expectations for readers which influence their interpretation of the graphic. Although no summary can do complete justice to complex concepts, Ives (1982) has isolated six key gestalt theories:

1. Theory of proximity. Items near each other belong together. For example, two words close together on the graph are seen as a single label.

2. Theory of similarity. Objects sharing similar characteristics such as color, shape, or size belong together.

3. Theory of common fate. Objects grouped in a particular way will be expected to change in conformance to this grouping. When change does not follow this pattern, the change is difficult to process.

   Original set: ####++++@@@@&&&&
   Acceptable change: ####++++****&&&&
   Unacceptable change: ####+++* ***& &&&&

4. Theory of the objective set. Some states are perceived more strongly than others. For example, two lines which almost form a 90^0 angle are perceived as a right angle.

5. Theory of direction. Lines moving in the same direction belong together. This theory explains the reader's ability to follow the movement of lines after they intersect.

6. Theory of closure. If a figure is incomplete, the eye will fill in the missing segment. For example, the eye will see a complete box even though the lower right hand corner may be missing.

Gestalt theory explains in part why graphic displays can make a strong visual impression. Before the mind interprets individual segments of the graph, the eye has already drawn conclusions about the significance of the data.

The concept of holistic processing argues against the use of three-dimensional displays in most business reporting. In a three-dimensional graphic, readers perceive what C. Melody Carswell and Christopher D. Wickens (1987) call "emergent features." That is, perception of width and length lead to perception of area, which in turn leads to a perception of volume. According to Carswell and Wickens, this perceptual quality aids in correlation/integration tasks where several inputs must be combined for decision making, but not in tasks requiring separation or isolation of a dimension for decision making. In these latter tasks, a simple bar graph works more effectively. Edward Tufte (1983) intuitively follows the same reasoning when he recommends that the graphic display use the same number of dimensions as the object represented. For example, he claims that a graph depicting the rising cost of oil over time be expressed by simple bars rather than by increasingly larger three-dimensional representations of oil barrels since cost is a linear, not a three-dimensional, concept. Tufte bases his recommendations on the fact that many pictographs show a doubling in quantity by a doubling in area. However, the reader sees a more dramatic increase than the one intended since the reader perceives the figure as having volume, not just area. Although the three-dimensional displays can make a figure more visually interesting, they can make the data more difficult to interpret. In this case, the additional dimensions become what Tufte calls "chartjunk" and should be eliminated.

Although readers make immediate quantitative judgments about graphical data, William A. Simcox (1984) has found that readers do not use precise quantitative labels in encoding information from a graph. Instead the reader summarizes the data by applying a general linguistic label such as "increasing" or "decreasing" to the information. This tendency to summarize keeps data to reasonable levels so that the reader can compare stimuli. Although no two people will see precisely the same thing, Simcox believes that these slight variations do not dramatically alter the summarizing label. Given the readers' tendency to summarize, increased realism or detail in a visual will not necessarily improve reader comprehension. For example, according to Francis M. Dwyer (1967), linear representations and shaded drawings of a heart worked more effectively than photographs of a heart in teaching college freshmen to draw the heart, identify parts on a 3-D model, and answer questions about the heart's function. From later experiments with speech communication students, Dwyer (1970) concluded that subjects could absorb information more rapidly from line drawings because they contained limited amounts of information. The complexity of the visual design in more realistic illustrations provides the audience with too many stimuli. As a result, the audience may miss relevant cues for interpreting the information.

It should be noted that Dwyer's subjects were naive in biological functions. As these students gained familiarity with the workings of the heart, they could progress from line drawings to more complex presentations. One would expect a heart surgeon, for example, to be able to retrieve more information from an actual heart than from a line drawing. Business readers, however, are similar in some ways to Dwyer's naive audiences. They also need their information rapidly and directly. These needs can be met more effectively through less complex designs.

Simplicity of design seems most effective in ensuring readability of visuals. William S. Cleveland and Robert McGill (1984) hypothesized that:

> A graphical form that involves elementary perceptual tasks that lead to more accurate judgments than another graphical form (with the same quantitative information) will result in better organization and increase the chances of a correct perception of patterns and behavior.

Using experimentation and the theory and results of others' psychophysical experiments, Cleveland and Mc Gill found that some elementary tasks in perceiving graphic values are more accurate than others. The following list is ordered from most to least accurate.

1. Position along a common scale
2. Positions along nonaligned scales
3. Length, direction, angle
4. Area
5. Volume, curvature
6. Shading, color saturation

However, they also found that accuracy in judgment decreased in evaluating positioning as the distance between the two values being judged increased along an axis perpendicular to the common scale. This finding led them to suggest that their list of elementary tasks should be expanded.

Although many texts on graphic design advocate the principle of simplicity, there is a big difference between achieving simplicity and being simplistic. Just as readers may become offended by condescending prose, they may become offended by condescending graphics. Washburne (1927) discovered that "Above a certain quite low limit of complexity [complexity here refers to the number of comparisons called for, not the number of data points shown] increase in the number of data did not affect in any way the relative effectiveness of various forms." Tufte (1983) also claims that using graphic presentations to show only one comparison is a waste of valuable chart space. In fact, Tufte claims that "Graphical excellence is that which gives to the viewer the greatest number of ideas in the shortest time with the least ink in the smallest space" and cautions that "Graphical elegance is often found in simplicity of design and complexity of data."

According to these researchers, then, the writer need not limit the number of comparisons shown on a graph so long as these comparisons are presented well. However, the writer does have some limitations. The concepts on the graph and the concepts stressed in the prose should match. For example, if the writer wants to show that as population in a city increases, people walk faster, the chart can show velocity in feet per second on the vertical axis, population size on the horizontal axis, and the names of individual cities on the grid. In this way, the reader can compare not only speed and population but also differences among individual cities. However, the chart would not identify those cities having strict pedestrian laws unless the writer also wanted to make a comparison between speed of walking and these laws. If the chart shows information not relevant to the discussion, the reader may become confused as to the writer's point.

Visual Arrangement

In light of the previous discussion, two general rules for visual design emerge: 1) the visual arrangement must cause the reader to think about content rather than design and 2) the design must encourage readers to draw the conclusions the writer intended. This means that the writer may have to experiment with several arrangements to identify that which most effectively portrays the intended message.

For example, when preparing a report on the impact of the proposed opening of a new tin mine in the area, the writer will want to emphasize projected population growth with and without the mine. The writer could easily present these projections on a table or in several graphic forms. Because the writer wants to compare numbers and because the perception of line length is an elementary and relatively accurate task, a logical choice for graphic display is a bar or column chart. Figures 1 through 3 all present the same data in a bar or column format, but each figure creates a different visual impression (example taken from Bogert and Worley [1988]).

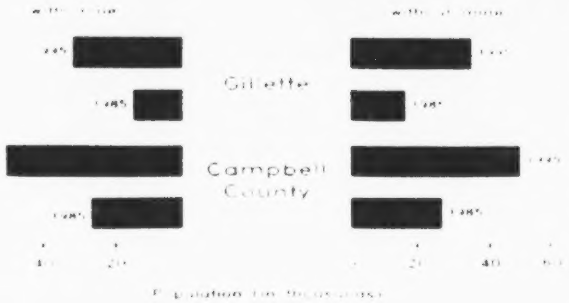


Figure 1
Population Increase in Campbell County and Gillette with and without Mine

Although Figure 1 does illustrate that population is projected to grow dramatically in both the city of Gillette and Campbell County as a whole over a ten-year period, the positioning of the bars obscures comparison between growth with and without the mine. Because this comparison is the key point of the graphic, Figure 1 is much less effective than a table, which at least would give exact figures rather than approximations.

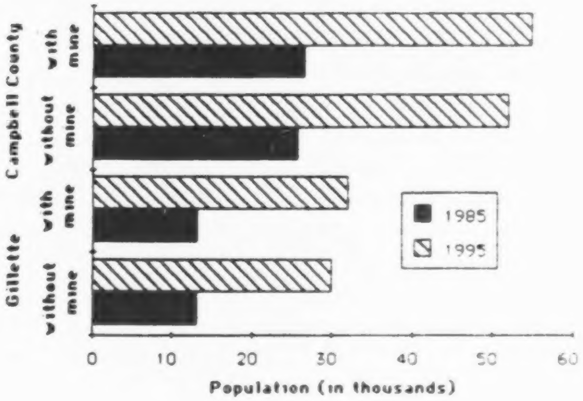
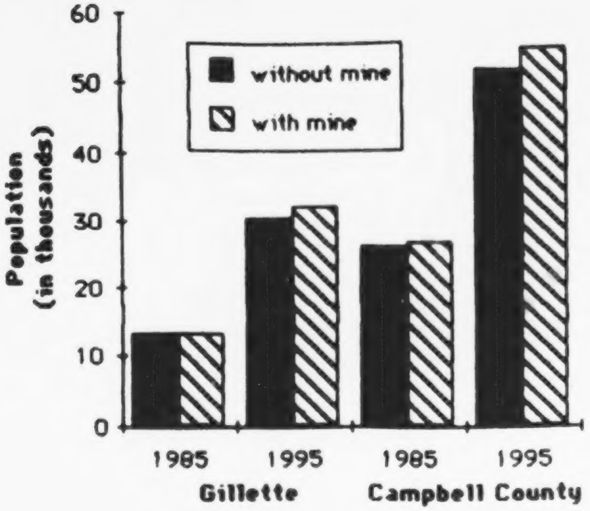


Figure 2
Population Increase in Campbell County and Gillette with and without Mine

In Figure 2 the bars are repositioned on the same directional plane to make judgments concerning line length easier. However, the visual emphasis still falls on increases in population growth per se and not on growth with and without the mine.



Regrouping the bars and replacing bars with columns traditionally used to suggest increasing numbers, as is done in Figure 3, allows visually for the comparison of both increases over the years and increases with and without the mine. As a result, Figure 3 presents a more effective visual arrangement than either Figure 1 or Figure 2.

Figure 3
Population Increase in Campbell County and Gillette with and without Mine

However, if the writer wishes to emphasize impact of population growth with and without the mine rather than actual growth itself, amounts are not as important as trends. In this case, simple line charts such as those shown in Figure 4 will work more effectively.

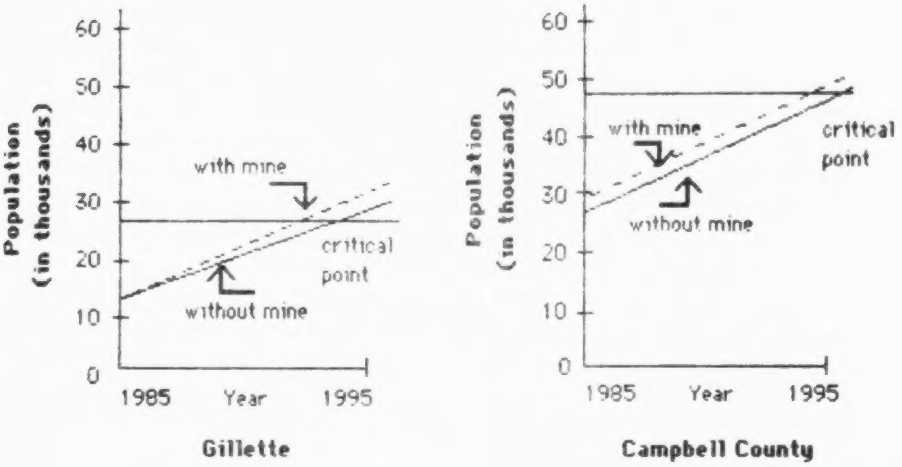


Figure 4
Impact of Population Increase on Gillette and Campbell County with and without Proposed Mine

The sharply increasing line visually underscores the growth trend even though it obscures the actual amount of growth. The small space between the lines indicating growth with and without the mine underscores that the mine will not have a significant impact. Moreover, the line chart allows for an additional comparison that is difficult to show in a bar or column chart. The writer can also show the critical growth point, the point where existing community services and resources will be stretched to their limits. This too helps to underscore impact since it shows that the critical growth point with and without the mine are separated by less than a year. Although the line chart necessitates placing data for Gillette and Campbell County on two separate graphs, the writer will lose little visual impact if these graphs appear side by side on the page.

Audience Familiarity and Preference

By considering rhetorical purpose, audience task, simplicity of design, and visual arrangement, the writer should create an effective visual. Unfortunately, even the most carefully designed visual can lose effectiveness if the audience is not familiar with it. For example, Edward J. Lusk and Michael Kersnick (1979) claim that people develop a "conditioning bond" with a familiar system. If given a different system, such as a graph instead of a table, they perceive the new format as more complex and more difficult to work with. They will also try to convert data to the familiar system before extrapolating concepts. These additional steps will slow productivity.

Others corroborate these findings. For example, John Glenn (1987) found that flowcharts worked less effectively in his organization than tables in illustrating processes because his subordinates had not been trained in the use of multi-page flowcharts. Becky Peterson (1983) also discovered a correlation between major courses of study and retention of information. Accounting, finance, management, and marketing majors retained more from reading narratives with tables; office administration majors retained more from reading narrative with graphs; and business education majors from reading prose alone.

These findings suggest that the more familiar an audience is with a visual mode, the more readily it will absorb information from it. If the audience has difficulty in identifying the format, it will spend more time looking at the format than at the data or it will misinterpret data. For example, the writer preparing the impact study discussed earlier could have chosen to show both trends and amounts on a surface chart such as the one shown in Figure 5 on the next page. Unfortunately, surface charts often mislead people who are not familiar with them. To determine the actual amounts in the second layer, the audience must subtract the point at which the layers join from the point at the top of the second layer. People unfamiliar with surface charts often ignore this mathematical step and attempt to read the chart like a line chart. These people will assume that the projected population figures for 1995 are much higher than they actually are and that the opening of the mine will have more impact than it actually will. Under circumstances like these, the graphic format competes with the message, rather than complementing it.

Linked to audience familiarity is audience preference for certain types of graphics or graphic elements. For example, Izak Benbasat and Albert S. Dexter (1985) discovered that audiences preferred working with colored tables and charts rather than with monochromatic displays because they felt that color increased readability and understandability of the information. T. S. Tullis (1981) also found that users preferred colored displays even though user speed and accuracy were similar for both color and black and white displays. Research suggests that color aids in only one task: the location of information. Sidney L. Smith found that color coding reduced visual search time and operator error rates in tasks that required the rapid location of information. In other tasks, color highlighting in prose may actually hinder comprehension because it distorts normal reading patterns. Robert Krull and Philip Rubens (1986) found that the color highlighted areas of a text drew the eye. As a result, readers often treated the printed page as a painting and scanned a page along the stream of color before reading the whole text.

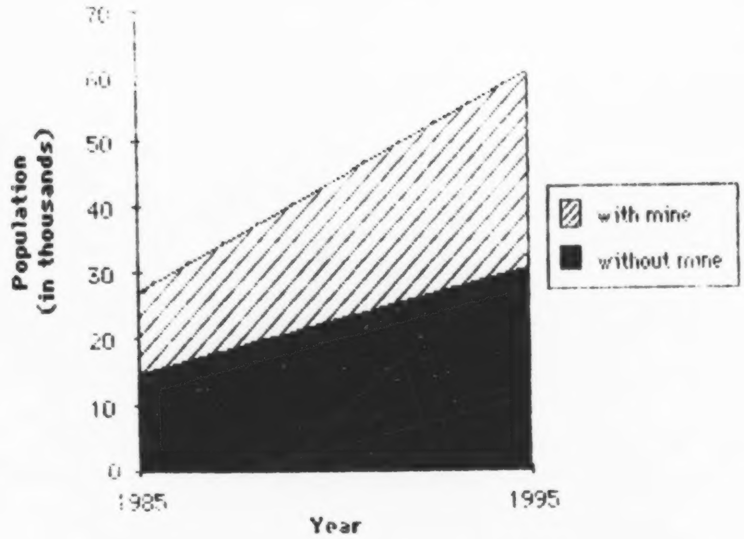


Figure 5
Example of a Surface Chart

Indiscriminate use of color can create additional problems. For example, large areas of an exceptionally bright color can create an after-image that makes comparisons to other components on the chart difficult. Colors that lack harmony will call more attention to themselves than to the data. Colors too close to each other in tone will begin to blend and make discriminating between data points difficult.

Despite these reservations, discriminate use of color in graphics can help shape meaning. For example, according to the gestalt theory of similarity, color can tie elements together or separate elements into discrete units. If an audience sees four lines of the same color, the audience will look for comparisons between the lines, but if an audience sees three lines of one color and one line of a different color, the audience will attempt to identify the way in which the contrasting line differs from the others (Sullivan, 1985). Moreover, colors do convey psychological and emotional meanings. For example, red suggests negative performance to a business person. Emphasizing falling profits in red, therefore, will convey both an intellectual and an emotional message.

Placement of Visuals in the Text

According to Richard W. Dodge's (1962) reports of studies conducted by James W. Souther on the reading habits of Westinghouse managers, only 10% of managers read material in the appendix of a report since material in an appendix is considered unimportant. These people usually read appendix material only if they mistrust the writer's conclusions or if they are intimately involved in the project covered in the report. It stands to reason then that the appendix of a report is not a good location for visuals that convey important messages. Ideally, these visuals should be incorporated directly into the text.

To get maximum impact from the visual, the writer should introduce it before presenting it. A. L. Yarbus discovered that, although individuals have no consistent pattern for viewing illustrations, instructions given prior to viewing determined what segments of the illustration received the most attention (Haber and Hershenson, 1980). In effect, this introduction serves as the thesis for the visual: Figure 1 shows the impact of mechanization on farm productivity. If the illustration itself immediately follows this introduction, readers will spend more time studying the comparison between mechanization and productivity, the key point the writer wishes to emphasize.

Although traditionally visuals appear in the center of the page immediately following this prose introduction, they need not be restricted to this location. N. Metallinos (Rubens, 1986) has found that readers process visuals containing factual information more readily if these visuals appear along the left side of the page. This would suggest that prose instructions, for example, should run down the right side of the page while the accompanying illustrations run down the left. If the visual is to be used several times in a report, the writer may want to repeat it several times rather than ask readers to page backward and forward in the text. This is especially true of tables (Rubens,1986).

Although current technology makes incorporating visuals directly into the text a relatively simple process, realities of page layout sometimes make precise placement difficult. When illustrations appear on the following page, they can interrupt the flow of the prose since the reader's eye tends to move away from the prose and toward the illustration. Although this placement slows the reading of the text, it does not apparently create confusion for the reader. However, readers do have difficulty in reading visuals, especially charts, that are laid lengthwise on the page. Ideally, charts should read from left to right just like the surrounding prose (Rubens, 1986). This suggests that oversize visuals will be used more effectively if they are reduced to fit vertically on the page. Although they cannot be reduced so far that details are no longer legible, print on visuals can be smaller than the print in the text itself. Because visuals use short phrases, members of the audience can read this material without becoming overtired (Tufte, 1983).

Because the writer wants the reader to perceive the text and the visuals as a unit, not as two separate pieces, visuals should not be boxed or otherwise isolated from the text. Studies at Rensselaer Polytechnic Institute suggest that readers view boxed material as an afterthought and, therefore, as unimportant (Rubens, 1986).

Although Tufte (1983) claims that well-designed illustrations should speak for themselves, most writers will want to elaborate upon their concepts in a discussion section following the presentation of the illustration. Unfortunately, some writers use the discussion section to repeat data shown in the illustration. Washburne (1927), Wright and Reid (1973), Tullis (1981), and Peterson (1983) have demonstrated that paragraph format will not work as effectively as a graphic format in conveying statistical information, so simply repeating data in words is a poor use of space and the reader's time. Instead, writers should elaborate on the conclusions or highlight the significance of the data in the discussion section. In this way, words and illustrations complement, rather than compete, with each other.

The technique of introducing, presenting, and then discussing visuals works very effectively for those who read entire segments of a report. However, many business readers will only skim reports, stopping to read only those sections which interest them. To keep these readers on track, writers should provide a title for every illustration. The title substitutes for the thesis other readers will find in the prose introduction to the illustration. Raymond Lesikar (1980) suggests designing titles by using journalism's five W's: who, what, when, where, why. In some cases, the writer will also want to add an H: how. Although the writer does not want a title to become overly long, the best titles will include as many answers to these questions as possible. Jeremy Foster and Peter Coles (1977) suggest that printing these titles in boldface works effectively in calling attention to the visual without separating the visual from the text.

Summary

In light of this existing research on graphic usage, writers should consider the following guidelines in designing visuals for their reports:

- Use visuals to highlight key points only.
- Match audience task and rhetorical purpose with the most appropriate graphic format.
- Favor the graphic format with which the audience is familiar.
- Prefer simplicity of design and complexity of data.
- Refine design by considering accuracy of perception tasks.
- Use color with discretion.
- Incorporate visuals directly into the text.
- Employ the principle of introduce, present, discuss, when incorporating visuals into the text.
- Provide a descriptive label for all visuals.

By applying these guidelines, writers can create visuals which complement, rather than compete with, their prose.

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Task Analysis for Visual-Verbal Cross Coding Learning Tasks

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This paper is about an anecdote and there is a moral to the story. The anecdote is from real life and the moral bears a message about the power of sight and the weakness of looking but not being able to see. Much of what is to follow relates to the teaching of learning-task analysis (L-TA) as a sub-process of instructional design and development. Admittedly, L-TA is not the most exciting topic one could imagine. Rather, the analysis of learning tasks usually is a subject of interest only to instructional designers and those who teach instructional design. Well, maybe a few visualization specialists might have a modest interest in instructional design in **general**. They would relate to the topic as one of many subject areas that provide a significant relationship between visual and verbal components. But, under normal circumstances the **particulars** of task analysis would likely be beyond the boundaries of their professional concern. Hopefully this anecdote will establish a relevant connection.

Instructional Design

Instructional design is concerned with finding solutions to instructional problems. **Systematic** instructional design is an outgrowth of general systems theory and has borrowed heavily from behaviorists and educators who espouse the use of behavioral objectives. The practice of using systematic instructional design techniques is often referred to as a "systems approach." A basic characteristic of the typical systems approach to the design of instruction is that it conforms to a **predetermined sequence of design steps.** In its simplest form that sequence begins with the identification of an instructional need -- or as some people term it, an instructional "problem." The design process follows (designing is typically broken into a series of sub-steps). Eventually the instruction is implemented, and the last step of the procedure is to evaluate the effectiveness of that instruction to determine whether the needed learning actually occurred.

Early-on in the systematic instructional design process the designer should analyze the learning task. That is, the designer should determine, as well as possible, just what the student must already know and be able to do **prior to instruction** and what the student will be doing physically and cognitively **during instruction** in order for the prescribed new learning to take place. When this L-TA is done formally, one of the products is a task analysis diagram. Tnat diagram is a physical layout of words which describe concepts and events so that they may be viewed simultaneously. The intended visual purpose of the format is to juxtapose elements so that the hierarchical and logical relationships of the components are readily apparent. In effect, the task analysis diagram is somewhat of a cross between a computer flowchart, an English sentence diagram, and a concept map.

AN ANECDOTE:

The problem...

The difficulties that a long stream of this author's students have encountered learning to do L-TA are legion. To state it in simple terms, only about half of each class ever fully understood how to do a task analysis, and of those who comprehended the theory, many experienced difficulty preparing an analysis diagram. Too many. The *results* of my conscientious efforts to teach and their serious efforts to learn were nothing to brag about.

An easy reaction to those results might have been to say, "So, the material is difficult to learn! Tough or easy, it's up to the learner to figure it all out. It just happens that learning how to do task analysis is what makes the ID course a hard course." Or, "It isn't my problem. The teacher and instructional designer have done their job once they have provided the information." But those kinds of response are just ways of refusing to acknowledge that failure to learn is a **problem** and that until a solution is found it is everybody's problem -- instructional designer, teacher, and student.

Actually, the problem was quickly spotted and acknowledged for what it was. Over the semesters several unsuccessful remedies were tried. Nothing seemed to help very much. The amount of time to be spent upon the subject was extended. Alternate and supplementary examples were provided. Small group and individual demonstrations were added to the initial large group presentation. Visual aids were improved. Explanations were repeated. And repeated . And repeated. To no avail.

In this ongoing situation the reason for my failed teaching and the students' deficient learning continued to elude me. The puzzle was all the more irritating because the L-TA procedure, once conceptually integrated in the mind of the instructional designer, is relatively simple. Indeed it was mysterious that droves of students were having a hard time learning something so easy. Why didn't they learn? Why? Why? Why? Six semesters slipped by with no satisfactory answer to that question.

Seeking a solution...

When students encounter difficulty learning simple concepts, it follows that a serious instructional problem exists. When an experienced instructional designer cannot correct that kind of problem easily, the chances are good that some mental block is getting in the way of a simple solution. Accepting that possibility, this instructional designer decided finally to place his trust in the systematic instructional design process itself. Accordingly, half a dozen student designer teams were given the assignment to design (re-design) a unit of instruction to teach others how to do learning-task analysis. In effect, one entire instructional design class spent the majority of their semester dealing with the L-TA sub-step. They even went through doing a L-TA to break the learning-task analysis process itself down so that its concepts, skills, and procedures could be laid out and displayed. Armed with their resulting diagrams the student teams designed and tested ways to teach the L-TA concepts, skills, and procedures.

The results were interesting, but not spectacular. None of the modules worked any better than the several relatively unsuccessful methods attempted by your author. However, as each of the modules was given a tryout, something caught my eye -- not something that was necessarily part of the instruction, but instead something that was evidence of one of the tryout student's learning skills. That student was an intuitive quick learner, one who seemed to catch on quickly and had no on-going difficulty with the diagramming concepts or with putting her knowledge into practice. When noticed, the bright student was working on prototype materials that included both written explanations and sample diagrams. She had a handful of different colored highlighters with which she was giving the words a color-coded tie to the visual/spatial characteristics of the diagram format. Apparently her intuition had told her that to learn this stuff she must bridge the visual-verbal gap. Her reaction was simple and effective.

To use a verbal cliche, "It (the key) was right in front of our eyes and we couldn't see it." Indeed, many others had groped with this particularly vexing roadblock to learning and failed to perceive the obvious. What we all had overlooked repeatedly was the true nature of the problem. Consequently, none of us had found the simple solution. The nature of that problem, the reason that so many of us failed to "see it" was that we had been primarily using the techniques for teaching cognitive verbal concepts when **our actual learning task involved bridging visual and verbal learning**. [Nagging questions will haunt the author for a long time: Why hadn't that shown up in our own task analysis when we first designed the lesson so many semesters ago? Why is it so natural to focus upon verbal constructs to the detriment of visual ones?]

So we went back to the drawing board. First we needed a way to concurrently display both the verbal and the visual information. Several options were available, and the least expensive available presentation medium was the printed page. Therefore, we elected to create student handouts with L-TA examples that contained all of the diagramming conventions. Fortunately we were able to take our examples directly from the textbook which we use (Dick & Carey, 1985). There were diagrams for procedural learning tasks and for analyzing the tasks of learning hierarchical content. That was double good luck because the examples were more than adequate, and students seem to be more comfortable working with material from their textbooks. (Text authors are totally credible. It's the security blanket effect, or some such illogical thing.)

Anyway, not only were examples readily available, but also the textbook diagrams provided a parsimonious, thus elegant, solution. Dick and Carey had devised their examples so that a single diagram contained examples of all of the diagramming conventions that our students would use to display the analysis of the learning task when the content was procedural. Another Dick and Carey example provided a single diagram with all of the hierarchical diagramming conventions.

We printed new versions of each of these two diagrams with a written explanation of all applicable diagramming conventions on the same sheet as the diagram. Thus, the diagramming "rules" were there *verbally* in words, and the diagrams themselves contained graphic *visual* examples of how those rules should be applied.

Then came the easy part -- the instructional strategy. Taking our lead from the intuitive quick learner, we presented the material as a hands-on exercise. Each student was provided with a set of red, orange, blue, yellow, and green highlighter pens and with the first handout. The instructor placed a transparency copy of the handout on the overhead projector and read the first convention (rule) aloud. At the same time he highlighted the words with a felt tipped pen and instructed the students to highlight the same rule on their individual handout copy. Next, the instructor used the same colored felt marker to outline the elements of the diagram that corresponded to the highlighted convention. The students were asked to color their own diagrams in the same manner. A similar procedure was followed with a different colored pen for each of the other conventions, emphasizing with each change of pen that the same color was being used on the written rule as upon the corollary of that rule as shown in the task analysis diagram.

The exercise took only a few minutes. The results were obvious, even before the evaluation was completed: Success at last! The students had integrated the rules and their applications without the confusion and agony of so many of their predecessors.

Not only that, the students enjoyed the break from the normal classroom routine, and the motivation carried over into subsequent lessons.

The Moral of the Story, Conclusions, and Implications

This little anecdote about a camouflaged problem and its ultimate easy solution would be of little value if the anecdote were all that there is to the matter. Was our problem completely unlike any others that may come along? No. In fact there are other analogous situations that come to mind almost immediately. For example, a high percentage of computer science students encounter difficulty learning to design flowcharts (an easier chore than fabricating a task analysis diagram.) Also, the latest fad, desktop publishing, presents any number of germane analogies related to the difficulty students encounter learning to visually display text so that the layout complements the content. Yet another example: Media design students frequently seem to be obtuse when learning how to create visualization ideas to complement a written script. The list could be made much longer.

Bloom (1956) and others (Krathwohl, et al, 1964; Harrow, 1972) have posited domains of learning and have developed taxonomies to identify the many kinds of learning that fall within a few general categories. A generation of instructional design theorist have elaborated upon these taxonomies, prescribing techniques for making instructional events appropriate to particular kinds of learning (Gagne, 1965; Gagne, Briggs & Wager, 1988; Martin & Briggs, 1986; Reigeluth, 1979, 1983; and many others). By-and-large, however, the characteristics enumerated in the taxonomies and the prescriptions that followed are targeted at aspects of the learning task that are not associated with sensory input or with metacognition. Translating a verbal message into a visual image within the mind is, for example, a metacognitive act. Moreover, it is an act inseparably linked to the visual sense in a way that reading is not, e.g., we can read via braille or via sight, but visualization is prima facie a sight-linked act only.

The visual aspects of learning have not been completely ignored by the learning/instruction theorists. Still, only a miniscule fraction of the total thought and effort that has gone into building a theory for instruction has had a visual component. The lack of emphasis on visuals , visual thinking , mental imagery, and so forth created the conditions under which a verbally oriented systems approach could exist that would host the events of the anecdote told here. More attention to existing theory about sight-related learning might have led to a much earlier solution to the learning problem described herein. Close attention to Landa's (1974, 1983) Algo-Heuristic Theory of Instruction might have prevented the problem in the first place. [Landa identified "image" as one of three kinds of knowledge. Specifically, he suggested that his theory provided a technique for "*Identifying* the *learning procedures* leading to the development in learners of performance algorithms or heuristics..." (Landa, 1983, p. 208) -- which is, more or less, what T-LA is all about.]

Gagne and White (1978) identified four kinds of memory structures, including "image" memory structures which closely resemble Landa's (1983) "mental image" classification. Merrill (1983) accepted Gagne and White's four kinds of learning as a major building block when he proposed his Component Display Theory. However, he did not explicate the application of his theory for either episodic memory structures or image memory structures. Reigeluth (1979) (Reigeluth & Stein, 1983) in his Elaboration Theory followed Landa's example, paying (only) passing attention to the visual component. To his credit, though, he did propose "dual encoding" to provide "visual as well as verbal examples." (Reigeluth & Stein, 1983, p. 355) [Dual encoding was one of the things that failed in our anecdotal incident. The strategy which finally worked would more appropriately be termed "cross encoding."]

To rephrase the moral of this story, there's more to L-TA than meets the eye. The fact that there are at least as many types of learning tasks as there are kinds and levels of learning may cause us to misidentify the true nature of a learning task. If we fall into this trap, the consequences can be severe. Inappropriate instruction may get designed, and all because some kinds and levels of learning tend to predominate. The tendency to try to force the wrong identification upon an instructional analysis is just as fatal to the ultimate learning outcome as when a learner attempts to force the wrong metacognitive strategy into the personal learning process.

A Typology of Tasks

Which leads to the major suggestion of this paper that *learning taxonomies should be supplemented with a learning-task typology*. Moreover, identification and inclusion of a comprehensive, extensive set of learning-task types should be the goal when that typology is created.

Development of a learning-task typology is not the purpose of this paper, but even a cursory consideration of what might be included would have to include learning content-specific visual-verbal translation, learning the visual correlates of most of the lower level cognitive learning skills, all of the tasks of metacognition -- and particularly those that apply to visual learning situations. The design of instruction that appropriately has a visual component would be greatly facilitated (and, arguably, improved) if instructional designers had such a typology and were trained in its use.

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Film Archives: Preserving Our Heritage

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The history of film archives is a patchy one, although not a dull one. A review of archives offers a fresh perspective on the field of visual communication, as well as informing us of the resources available today for making access to moving image materials possible. It provides a chance to reflect on how attitudes towards moving image materials are changing, and develops an awareness of the issues and policies concerning the establishment and function of film archives, as well as how an awareness of each of us can benefit in our own work from their use. We tend to categorize film as either for use as entertainment (subjective use) or as a tool and source of instructional or factual information (objective use). These are certainly important functions of film, but limiting ourselves to them obscures another value of film, and that is its historical value as a document and resource of what a given society at a given point in time chose to see and how they chose to express what they saw. If we can examine the ways in which others represent the world, themselves and others, we gain a deeper, fuller and more accurate understanding of how we view the world and represent ourselves. And film more than any other medium offers us the chance to verify or refute ideas about our history. Unfortunately though, it is among the most fragile of media and has a finite lifespan: If we are to have it in the future, we must think about it now.

Moving image material preservation is in many ways an orphan field. It was more than thirty years after the first films were produced in the 1890's before any attempts were made to systematically collect, care for and catalogue films. In spite of the extravagance and abundance of its productions, the American motion picture industry has done little to preserve film or any of the materials associated with their production, such as scripts, scores, and posters. Nitrate films wre destroyed regularly when they were sold for recycyling of their silver content. Although film companies, perhaps suspicious of other companies copying their work, were territorial enough with scripts in the earliest decades of picture production that they wrote on actor's and actresses's scripts, "Save Your Script, Save Your Job" (Lawrence, 1970), they later discarded the same scripts. One producer, Walter Wanger, did begin a script collection at Dartmouth in the 1930's (Lawrence, 1970), but such acts have been rare, perhaps because the film companies did not forsee in them any financial benefits.

Attempting to separate the technical history of film and the history of efforts to perserve it is like trying to separate a Chinese finger puzzle. The harder you try to separate them, the greater is the realization that you must consider them together. A purely technical history of the medium fails to arrive at a realization of its educational, cultural and historical significance. Yet the physical properties of film determine preservation requirements, and anyone involved with its preservation must have a basic knowledge of its technical aspects.

For the sake of clarity and brevity mostly U.S. invention dates are used throughout this paper, but please keep in mind that film has an international history. Parallels of American inventions and discoveries occurred at roughly the same time in some European countries. Eastman's gelatin emulsion was first available in 1880 (Baumhafer, 1952); until that time the support upon which photographic images were made was glass, metal or paper. When commercial manufacturing began, the gelatin emulsion products could be more uniform and therefore began to be more scientifically controlled. The refinement and exactitude of materials allowed by manufacturing, as well as the actual discovery of the gelatin emulsion and other substances, were prerequisites for the development of film for large scale use and especially for use of the production equipment that would be designed. Eastman's invention was closely followed by Reverend H. Goodwin's invention of the first flexible film (Baumhofer, 1952), and seven years later, in 1894, Edison submitted to the Library of Congress the first film to be copyrighted in the U.S., "A Kinetescope Record of a Sneeze" (Niver, 1983), a forty-five second film of a Mr. Fred Ott sneezing. Because films were not yet considered a discrete separate medium and were expensive to copy, until 1912 paper copies were submitted to the Library of Congress. (With the use of special machinery invented by Kemp Niver at the Library of Congress, these have since then been copied onto film.)

The year 1892 is significant in the history of moving image material preservation in three respects. This year marked the beginning of the use of nitrate cellulose film. It would be another forty years before films more stable than cellulose nitrate film were discovered. Thus began what has long been the curse of film archives: to preserve the deteriorating images recorded on nitrate film before they spontaneously combust. The problems of spontaneous combustion were first described in 1936 by Nuckolls and Matson (cited in Hendricks, 1894). Nitrate film is of the same chemical composition as gun cotton and is therefore an explosive. In addition to atmospheric temperature sensitivity (temperatures as low as 120 degress F. can cause nitrate to explode), as nitrate film ages and deteriorates it releases nitrate gases that raise its own temperature. Finally, because nitrate film also releases oxygen as it burns, there is no way of extinguishing the fire.

It is because of the dangers of nitrate film that "bubbles" were first constructed around cameramens' chairs and in projection booths at theatres. Several major fires have been caused by nitrate film, although not all of them from spontaneous combustion. The documentary filmmaker Robert Flaherty lost 70,000 feet of film from his Belcher Island trip when he accidentally dropped a cigarette butt while packing the film for shipment to Harvard (Rotha and Wright, 1980). A major fire was caused by spontaneous combustion in Library of Congress storage facilities in Suitland, Maryland in the 1970's. Recognizing the fire hazard presented by nitrate film, the Division of Motion Pictures, set up in 1935 as part of the National Archives, established 1000 feet as the unit of isolation for film (Arbaugh, 1939). Nitrate vaults are also built with special walls and vents. Because the gases they release can harm other film, they should not be stored near other kinds of film.

Both cellulose diacetate and cellulose triacetate were developed in the late 1920's. The National Bureau of Standards estimates that while nitrate has a life span of one hundred years, acetates can have a lifespan of up to five hundred years (Arbough, 1939). In 1951 Imperial Chemical Industries (ICE) in Great Britain introduced polyester film, commonly known as Mylar, Estar and Cronar. In addition to its chemical inertia, it is known for its dimensional stability. In other words, not ony is it less flamable than nitrate cellulose, but it does not shrink as readily from plastic evaporation. In 1977 polyester was declared the permanent record material for the National Film Archives (Hendricks, 1984). Although archives can now copy nitrate film on to these other "safety" films, then destroy the nitrate, it is a costly and time-consuming process. Most archives that house nitrate still have a backlog of nitrate film waiting to be transferred to safety film.

A second portentous event in 1892 was the establishment of the first movie studio by Lillian and Frank Gilbreth (Baumhaufer, 1956). The Gilbreth's use of film for entertainment altered the history of film use. Prior to the establishment of feature film studios, film had been used primarily for study and scientific purposes. Although the financial benefits for equipment and film manufacturers that this broader use of film entailed meant that discoveries in film chemistry and the mechanics of equipment design accelerated, it also meant a shift in attitudes and perceptions of what film use was all about. Much of the reluctance to preserve film since then still rests on its being perceived as mere entertainment, frivolous and therefore undeserving of preservation. That this would be the case was, in fact, recognized immediately by some serious cinematographers. Boleslav Matuzewski, a Polish cinematographer under Nicholas II in Russia, in 1900 wrote cautioning how the media should be used, warning that it had to refrain from "purely recreational or fantastic subjects" and move "towards actions and events of documentary interest," and go from "the slice of life as human interest" to "the slice of life as the cross-section of a nation and people" (cited in Kula, 1983). Instead, the medium quickly became one dominated by a profit-driven entertainment industry, a stigma it still holds.

The third event of 1892 was Gladstone's observation of the rapid deterioration of film, in monsoon and heat-ridden India (Hendricks, 1894). His observation was largely forgotten since it was to be decades before its significance was fully understood. Although the effects on the stability of photographic materials of thoroughly removing fixing salts during the development process was documented as early as 1866, Gladstone's observation was the first time the effects of atmospheric and environmental phenomena on the stability of photographic materials had been acknowledged. The effects of, and consequently the need to control, relative humidity and temperature in the storage of film is now among the crucial scientific understandings making moving image material preservation possible.

Four factors are now known to affect the stability of photographic materials: 1) temperature; 2) relative humidity; 3) chemicals (those used in the product; residues remaining after processing; and pollutants from external sources such as exhaust fumes and xerox machines); and 4) irradiation (Leary, 1985). Films are gelatin based and therefore water soluble, so relative humidity is critical, since moisture has the potential to dissolve the film (Hendricks, 1984). Excess moisture also provides a breeding ground for fungi and bacteria. The optimum temperature and relative humidity for storage of color film, black and white film, and magnetic sound vary slightly, but all are between -4 and +5 degrees centigrade and under fifty percent humidity. It has been found that it is really a combination of two or more of these factors which determine film longevity (Hendricks, 1984; Kula, 1983). Also important is the consistency of temperature and relative humidity. Film subject to constant temperature or humidity alterations, because these cause it to expand and contract, loses its stability. Maintaining proper conditions for film storage requires temperature and relative humidity-controlled vaults and constant surveillance, making film storage costly.

Color film presents problems of its own; it is especially sensitive to ultraviolet irradiation from sun and flourescent lights. Color film fades noticeable within ten years of processing, and although new technologies to "retrieve" the color may exist in the future, at this point in time nothing can be done to restore color. Particularly since most films today are color, this is becoming a greater concern for film archivists.

In the eighteen-year period following Edison's patent for his film on Fred Ott's sneezing, 5,500 films were registered for copyright at the Library of Congress. By 1912, the Library of Congress had begun to recognize film as a separate category from books, and thus accepted reels of film instead of the paper prints they and previously accepted for copyright purposes. However, because of the danger to other materials presented by storage of nitrate films, it was decided that, upon issuance of a copyright, the film would immediately be returned to its owner and a script be retained in lieu of the actual film. For this reason the Library of Congress collection now contains a substantial collection of supplemental material but few of the earliest films (Herrick, p. 11).

By the mid-30's several European countries had begun film archives, mostly government sponsored. U.S. archives were for the most part privately funded. The Museum of Modern Art began its film archives in 1935 with a three-year grant from the Rockefeller Fondation, and James Card established a collection at the International Museum of Photography at the George Eastman House in Rochester, N.Y. in 1948. In spite of suffering from funding problems, both of these organizations have managed to acquire and preserve admirable collections. Both have backlogs of film awaiting funding to be transferred to safety film or to be repaired. Beginning in 1942, the Library of Congress and MOMA worked together on a project funded partially by the Rockefeller Foundation to preserve films (Herrick, p. 11). This was the first time that archives would coordinate their efforts, an important organizational step; it also revealed that different archives were going to have different criteria for judging films and establishing priorities .

Within the U.S., by the 1950's several groups concerned with preserving moving image materials began to exchange information. Among them were the Picture Division of the Special Library Associaton, the Graphic Historical Society of America, the Eastman House and the Society of American Archivists' Committee on AV Records (Baumhofer, 1956). In 1958 Congress began granting yearly appropriations towards the preservation of film at the Library of Congress; the funds were scarcely enough to finish copying the paper prints in the pre-1912 collection, but at least were now regular (Herrick, p. 19). By 1967, grants for cataloguing purposes, from the National Endowment for the Arts, the Ford Foundation, and the American Motion Picture Association , had been pooled to form the American Film Institute (AFI), the first U.S. archives housing foreign films as well as American-made films. AFI worked with the

Library of Congress, coordinating work on preserving nitrate films, with the equipment housed in Library of Congress facilities and the AFI providing technical and historical aid.

Non-feature film archives have been among the most recent to come into existence. The U.S. National Archives had housed U.S. government-produced films since the 1940's, including such films as Pare Lorentz's "The Plow That Broke the Plains" (1936) and "The River" (1937). Although the U.S. government was always reluctant to become involved in film production outside of war propoganda films, in the 1970's the Smithsonian Institution began the Film Study Center, an anthropological film production center and archive. This was disbanded in 1978 and a few years later the Human Studies Film Archives was begun. As well as containing the films produced under the Film Study Center, HSFA has expanded and now includes considerable amounts of earlier footage, including work by Robert Gardner, Melville Herskovits, and Timothy Asch and Napolean Chagnon's extensive work on the Yanomamo Indians. HSFA preserves and seeks to make accessible to researchers both amateur and professionally produced, Western and non-Western anthropological and ethnographic film. It has the difficult task of cataloguing and making available to scholars and researchers large numbers of outtakes as well as edited films, and also often deals with films requiring annotations as well as soundtracks.

Some universities and a few public libraries maintain film collections. These archives have relied primarily upon donations from private individuals and film producers. As with other archives they are understaffed and underfunded and have backlogs which cannot be made available to the public until they are catalogued. The University of South Carolina houses a large collection of Fox newsreel footage and New York City's Shomberg Library contains an important collection of footage on blacks and another on dance. The State Historical Society of Arizona and the University of Baltimore have begun strong collections of local and regional television news footage.

The AFI has been instrumental in expanding the nature of film archives and has begun to assist organizations and archives preserving local footage. In 1983 with the help of some NEA funds they created the National Center for Film and Video Research. Interest and participation in this organization quickly grew and in 1987 their annual conference included over seventy people from forty archives, including representatives from ABC, CBS, historians and the International Federation of Television Archvies (FIAT). They publish a monthly "FACTAC" newsletter.

One of the most recent and promising of the regional archives is Northeast Historic Film in Maine, an independent film archive begun two years ago with a collection of 666,000 feet (about 300 hours) of Maine television news coverage shot between 1953 and 1974 and donated to them by a local television producer. Unlike most archives, Northeast Historic Film actively seeks to make their holdings known to the general public; they spend about thirty to forty percent of their budget on outreach and dissemination activities and have collaborated with other organizations on several projects. In one project they worked with a state folklorist at the University of Maine in Orono, using some logging footage shot in the 1930's to help elicit information in oral history interviews with loggers still living. In this respect Northeast Film is unique among archives, which traditionally do not devote themselves to outreach work or collaboration of any kind outside of other film archives.

Northeast Film is currently using the WABI television footage in a pilot project in the state school system. An important feature of this project, and one characterizing Northeast Film's philosophhy and accounting for much of their success as an archive, is that they have actively sought community involvement in this project from its inception. They created a board of directors comprised of members of the community to work on the Maine Teachers Project, and strive to include the teachers in all phases of the project, from footage selection to curriculum integration to deciding the scope of the project. By thus creating a sense of "ownership" they are able to educate and inform the public of the value of and problems of moving image material preservation. The project involves working with twenty elementary school teachers to design a social studies curricum using some of the news footage. The teachers have chosen three topics-transportation, television commercials in the 50's and 60's, and Cold War issues-each of which will be included in two to five minute non-narrated videotaped segments accompanied by a written key. Since the transfer from film to video is being donated by the television station, the cost of the program is relatively inexpensive.

It is archives like Northeast Historic Film, smaller archives that are closer to the community, that are in a position to change attitudes towards film and create an awareness of the need for its preservation. Relying on faith in new technologies and a blind wish that science will soon find a way to save what needs to be saved will merely result in a loss of irreplaceable material. Whether any other medium will in the future replace film or not, nothing can replace film from the past once it has deteriorated or is destroyed. And because nitrate film, containing the oldest of images recorded on film, is so prone to rapid deterioration, we have already lost a good chunk of our priceless heritage, a piece of it that will never return. As professionals concerned with visual arts, we are responsible for being aware of the isues and problems involved in preserving moving image materials.

Resources

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Providing Access to Visual Information

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Providing access to visual information should not be very different from providing access to any other kind of information, and making information available is at the heart of librarianship. Access to information, in its broadest sense, means "making available whatever might be needed from the entire body of recorded knowledge no matter when, where, or how it originated and is stored" (Intner, 1984, p. 7).

Users of libraries need both physical and intellectual access to knowledge in all its forms. Physical access means the availability of books, documents, audiovisual, and electronic media, while the term intellectual access denotes the availability of information about what the books, documents, audiovisual, and electronic media contain. Physical access to a library's collection of materials is provided by the library's classification scheme, which determines the way materials are arranged on the shelves, and by indexes to the classification scheme. Intellectual access to information is provided primarily by the library's catalog of its own collection and by bibliographies, indexes, guides, and other reference aids which list and/or describe the larger world of information.

The goals of librarianship intersect with the goals of visual literacy at the point of library access to visual information. The ability to read, interpret and communicate with visual images is a primary goal of visual literacy. Hillel (1987) gives a spare but elegant definition.

> "Visual literacy is an ability to interpret by means of trained perceptual capacities feelings, ideas and information; and to communicate them imaginatively with compositions created via a diversity of visualizing mediums."

To interpret images, one must first have access to them. This becomes the point of intersection, for the library's goal is to provide its users with access to information and to resources--resources which may hold for the user knowledge, information and pleasure. From these two intersecting goals one might expect that: 1) teachers would be able to find and use the form of information most appropriate to their curricular objectives and strategies; 2) learners would be given the opportunity to experience and learn from many forms of print, audiovisual, and electronic media. These expectations are reasonable but their realization is still the exception rather than the rule.

This paper will discuss three ways to improve access to visual information, ways which seem obvious when we examine the problem. Edward de Bono (1971) has defined creativity as "unpredictable effectiveness." The notion might be applicable here. He explained,

> Unpredictable simply means that it is obvious once you've got there. On looking back it is obvious why it should be effective; but when you are at the starting point you just cannot see it. This jump from the start to getting there and looking back, is to me, a very useful definition of creativity.

Let us go back and forth from start to finish, concentrating on how users of libraries, particularly libraries in schools and colleges, can be led to discover the variety of visual information available in instructional materials. Libraries can provide more access to visuals through: 1) full cataloging of audiovisual and electronic media; 2) shelf arrangement of these media; and 3) provision for special handling and circulating of materials which are sometimes considered to be too labor intensive to be made a part of the collection. As obvious as these three approaches may seem, they are more often neglected than used. If we try these approaches, we may find them very effective--predictably resulting in "unpredictable effectiveness."

Print and Nonprint

For many years libraries have provided access to their collections through print catalogs, either catalog cards or book catalogs. In many school and college libraries there is an extensive catalog for books and a separate--and often less complete--catalog for audiovisual media. In such cases, to find and retrieve audiovisual materials requires of the library user both tenacity and motivation.

This arbitrary division of the world of resources into book/nonbook, or print/nonprint, has its roots in the development of libraries. Scrolls, clay tablets, and, in the last five hundred years, books, these were the repositories of the recorded knowledge, history, and dreams of peoples. Procedures for collecting, housing, and circulating them were in place long before it was possible to produce multiple copies of audiovisual materials. The introduction of films, filmstrips, and other audiovisual media into the curriculum in the twentieth century posed problems to book oriented librarians. The audiovisual materials were not as uniform in size as books, and equipment was often required to project and view them. They were different from books--so these media were rather condescendingly called nonbook, nonprint, or audiovisual aids. Their intellectual content was inadequately described (if described at all) in cataloging records. A 1955 survey of libraries by the American Library Association found that academic libraries were more apt to classify and catalog audiovisual resources than were public or school libraries (Intner, 1984). Since their audiovisual collections usually consisted of films and recordings, and since academic libraries have been the major contributors to online databases, database records for audiovisual materials have been limited to a certain extent to films and recordings.

In the 1960's the schools acquired large collections of audiovisual media, funded by the NDEA (the National Defense Education Act). These resources included 16mm films, filmstrips, study prints, S8 filmloops, charts, games, and three-dimensional objects. They were not so easy to classify, catalog, and house as films, and many schools developed their own nonstandard cataloging rules. Computerized catalogs and regional or national networks will eventually force standardization and will make the cataloging of nonprint materials easier, but this is not yet realized. A 1985 survey of school libraries, prepared for the Center of Education Statistics of the U.S. Department of Education, found that only 27% of all public schools used computers for library media center operations of any kind. Teachers should not have to wait for automation to have better access to audiovisual and electronic media.

Cataloging of Audiovisual and Electronic Media

One sure way of providing better access to visual information is to supply the same full cataloging for audiovisual and electronic media that is traditionally supplied for books. Full cataloging simply means the recording of complete information about resources, in particular instructional materials--information that will describe an item in the library's collection to the library user. The information about an item would include title; subject and/or curriculum area; type of media (slides, film, simulation game, etc.); a brief description of the intellectual content; publication date; where it was published or produced and by whom; number of pages or components in a kit; and grade level. This kind of information has always been available for books, and has been available for films and some filmstrips through a library's subscription or membership in a network (Library of Congress MARC records, OCLC database, etc.) However, cataloging for many forms of instructional materials is not available on these databases. These materials include: three-dimensional objects such as games, models, globes, rock samples, puppets, and the like; and two-dimensional, non-projected graphics such as art prints, transparency masters, and activity cards (Morrison, 1988). The most recent revision of the Anglo American cataloging code addressed the problem of standard descriptors for these materials; however, it was not until 1988 that a MARC format (machine readable cataloging) was established for all materials. Until fields for description of two-dimensional nonprojected materials and for three-dimensional materials were agreed upon, these materials could not be described forentry into a national database. This is the reason that many instructional materials in school libraries are still not represented in OCLC or other dational databases.

Libraries, especially school libraries or college curriculum libraries, have had to do their own original cataloging, which has resulted in a wide range of treatment. Some curriculum libraries have organized materials by the course in which they are used while other libraries may list these materials alphabetically by medium; in either case, the records are not a part of the main catalog.

The Edgar Dale Media Center, a college of education curriculum laboratory, was begun just ten years ago, so its practice was not tied to the past. In this center, full information about resources is provided for every item on the shelves; the catalog cards (the Media Center's catalog is in the process of being automated) are interfiled in a dictionary catalog; and all items are on the shelves. A survey of students' attitudes about media centers conducted before the center was in operation indicated their decided preference for the separation of books and audiovisual materials (Petrucci, 1980). We assume that these teacher education students reflected the library experience of their earlier schooling. Four years after the Center was in full operation, with an integrated catalog and an integrated shelf arrangement, a second survey indicated a preference for the Center's integrated arrangement. One of the Center's goals was to encourage students to seek information by subject, not form. In 1979 it was usual for a student to come to the Media Center and ask for a filmstrip; the content did not matter; it was the form that was important. Today a student looks for resources about a subject area, such as the Depression years. That student would be able to find a set of slides, individual slides, a jackdaw kit, a simulation game, many informational books, and adolescent novels, all dealing with America in the Depression years. Undoubtedly the Center has, in an unobtrusive way, influenced students' attitudes toward using all forms of information in their instruction.

Catalogs, Technology, and the Future

For many libraries, the benefits of technology are still in the future. The barriers a card catalog present to the user are still prevalent. Many users do not understand the order in which cards are filed, or the system of subject headings used. When the catalog is automated these barriers will disappear. Many points of access will be available. The computer can search with speed and accuracy and we may expect that interfaces will enable the computer to relate information about the collection to circulation and order files and to direct the user to the physical location of an item. A user will know if the item is on the shelf, if it is on order, how many copies are available, or where it is in the library.

The recent introduction of CD-ROM technology has led to new forms of access. One system, called the "Intelligent Catalog," provides immediate information about an item and then displays a map of the library, indicating the location of the item. Voice synthesis technology can be interfaced to provide auditory instruction to the user.

Prototypes of sound and motion databases such as CDI, compact disc interactive, have been demonstrated at professional conferences. One demonstration allows a user to look up DNA in an electronic encyclopedia, read a definition and explanation, and rotate the DNA molecule to observe it from several points of view. Voice synthesis and voice activated computers will expand the usefulness of electronic catalogs for users with some physical disability.

The introduction of hypercard or hypermedia allows us to examine layer upon layer of information, going from the general to the specific. A prototype recently created and demonstrated by a doctoral student at The Ohio State University (Franklin, 1988) provides: a verbal description of the word "Chicago," a graphic display of the city skyline, information about sports teams, the geographic location of the city, etc.

When the capabilities of hypercard or hypermedia are added to other library automation, library users will indeed have full access to all resources. The forms of present access and retrieval of information will soon seem very primitive.

In 1970 Mark Slade, a Canadian researcher, made some prophetic statements about media and electronic forms of communication. He said:

> "Two languages of change are available to us, both of them very powerful. One transmits data in motion. The other transmits the image in motion. One is the computer, the other film, television, and satellite. Before many years have passed, unheard of results will issue from the ungainly coupling of these two unparalleled language systems."

He went on to predict:

> "Our most crucial change is the reorganization of existing information. The language of change does not collect; it transposes, translates and transforms." (Slade, 1970, p. 5)

The transposition, translation, and transformation of information access and retrieval will enhance the use of all library resources; these changes will result in "predictable effectiveness."

Integrated Shelf Arrangement

A second way to improve access to audiovisual and electronic materials is to integrate the library's holdings by arranging items--all items--on the shelf by classification. (All items will be given a classification number, including the study prints, activity cards, games, etc., for which commercial cataloging is not always found.) Libraries who do this are arranging their shelves for the convenience of their users. Just as a library user should not have to go to two or more catalogs to find materials related to the same subject, so s/he should not have to go to several areas of a library to retrieve materials.

At one time library practice recommended that when a book was removed from the shelf for circulation, a block of wood be put in its place. This was done to signal to anyone looking for a particular book that it was "out." Obviously there had to be changes when a library's collection grew--where would all the blocks of wood be kept when they were not in use? We smile at this archaic practice but even today there are many libraries that put empty record sleeve covers on the shelves and keep the records in the back room, or have "jewel" boxes on open racks while the compact discs are safely locked away. Other practices include keeping all the audiovisual and electronic materials in a separate room, unavailable to the library user except by special request. Some school libraries still separate the components of kits, putting filmstrip containers in one place, records or tapes in another and teacher's guides on the reserve shelf. And some libraries that do integrate all their collection on the shelves cannot quite get away from the primacy of the book so they repackage their audiovisual materials and computer diskettes in boxes that look like books.

Librarians are apt to defend these arrangements by citing the damage or theft that might occur if the materials were on open shelves. The cost of installing a security system, a one-time cost, would surely answer the concern about theft. As for damage, would the cost of replacement equal the costs of staff time and the cost of extra space and shelving which separate arrangements require? These questions reveal concern about cost and efficiency. What about concern for the library user? Intner (1984) suggests that effective management of any collection of information can be measured in terms of resulting public service as well as in terms of operational efficiency. I am convinced that any item which is intended for use by the public should be on open shelves where the public can find it. That is public service!

Does the intershelving of print, audiovisual, and electronic materials make a difference in terms of use? To examine this question, a controlled study was conducted in the Edgar Dale Media Center at The Ohio State University in the academic year 1980-1981. All materials in two subject areas, American history and life sciences, were targeted and separated into books and audiovisual media. Then different shelf locations were designated for books and media for each of three quarters. In Fall Quarter, students who wanted to use audiovisual materials in the target areas had to retrieve them from an unused and inconvenient balcony area, while books in the target areas of American history and life sciences were left in the collection on the main floor of the Center. In Winter Quarter, the same books and audiovisual materials were reversed, so students found books in an inconvenient location. In Spring Quarter all materials were integrated on the shelves in the main floor of the Center. Careful records were kept for every transaction for this period of time. It was found that when books in the target areas were shelved on the main floor, their use was parallel to the use of all books in the collection. When they were moved to the balcony in the Winter Quarter their use dropped, and when all materials were integrated, the percentage of books borrowed increased while the use of audiovisual materials dropped slightly, but the percentage of use of all materials increased significantly. Tentative conclusions were: 1) intershelving does not necessarily increase ratio of use of audiovisual media as compared to books; 2) an integrated collection leads to increased emphasis on subject rather than on form; 3) easy access to all materials increases use of all materials (Cleaver, 1983).

An integrated shelving arrangement not only provides easy access to materials, it also promotes browsing. In a recent survey of 280 students in the same media center, 52% of the students said that they found appropriate materials by using the catalog and 48% found materials by browsing. Integrated shelving encourages browsing; it is an arrangement with the library user in mind.

Provision for Special Handling

Some materials by their very nature are difficult for libraries to manage. Slides, for instance, are often parts of large collections. If they are cataloged at all, they are usually cataloged as a set. This treatment works if the slides are accompanied by a script or audio tape, are focused on one theme, and consist of one or two slide trays. In such a case, they form a cohesive unit which has a title and subject and can be easily cataloged. Other sets of slides may number in the hundreds or thousands, be very generally related to a theme, and offer many possibilities for points of access and subdivision. Cataloging each slide separately is not a practical use of limited staff time, but without some cataloging, the library user is denied access to valuable materials. Some libraries avoid the issue altogether by not acquiring and housing large slide collections.

Some producers of slide collections have numbered the slides and listed them in categories; access is provided by an index with alphabetical, chronological, and topical access. In purchasing such a set, a library could provide subject access in its catalog by using the categories or topics found in the index.

The Edgar Dale Media Center has used this approach--a compromise which does satisfy the library user. The catalog provides access through broad subject headings while visual access to each slide is provided by the housing arrangement. Slides are arranged in racks, by the categories and numbering system of the producer, and the library user has only to view the slides on a rack which is lighted from the rear of the slide cabinet; the user then reads the descriptions in the printed index and selects the slides s/he wishes to use. The slides may be borrowed and, if the library has made arrangements for users to obtain copyright permission, may even be copied. The library user then can arrange the borrowed slides to meet his/her instructional needs. This library procedure is particularly useful for teachers, students with class projects, or anyone who plans to use visuals in a presentation.

Another example of improving access through special handling is for the library to provide portfolios or carrying cases for art reproductions and study prints, or to provide net bags for models, globes, pieces of sculpture, and other three-dimensional materials.

A multimedia collection is a challenge to the most ardent media librarian. There will always be problems in how to describe some of the resources; the shelves will never be as orderly as those which hold uniformly sized books; and it will never be easy to display or circulate all materials. Nevertheless, the library which provides full cataloging of all resources, has an integrated shelf arrangement of all materials, and creates special procedures for handling non-standard materials, will enhance the use of its collection substantially. Providing access to visual information is a challenge which, if met, will result in the more effective use of the collection. This would seem so obvious that we could have predicted it--looking back to early methods of handling audiovisual and electronic materials, and looking forward to the changes technology will bring about, we seem to be describing "unpredictable effectiveness."

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The Rise and Fall of the U.S. Film Service: Good Films Were Not Enough

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The historical research and reporting of the rise and fall of The United States Film Service has, in some cases, leaned toward reductionism. Reported, or at least implied, is a fight between far-sighted, creative film-makers on one side and narrow minded conservative congressmen as well as a strong Hollywood lobby on the other. The battle lines were not so easily defined. Contrary to this interpretation stands a middle ground. Personalities, specific events, and cultural implications of the Depression Era brought about the demise of The Film Service. It was not simply "good guys" versus "bad guys."

The Film Service came about as part of Franklin Roosevelt's New Deal. He wanted to use films as a part of an elaborate information system to tell "the people" about his new, often experimental and controversial programs. His enemies claimed it was propaganda, a way for Roosevelt to promote his programs through the use of films.{"Propaganda" during The Depression Era was thought to be something used by the Nazis in Germany, Italy and Spain. The word "propaganda" had an extremely negative connotation in this country. (Susman, 1983)}

This paper will discuss the rise of The Film Service through the auspices of government relief organizations, the films which were produced by Pare Lorentz and The Film Service, and its demise brought about by financial and political conflicts.

F.D.R. and The New Deal

The crash of '29 and the subsequent years of "Hoovervilles" turned America upside down. In addition, six years of drought and "dust bowl" conditions created an atmosphere of despair.

The election of Franklin D. Roosevelt (F.D.R.) in 1932 and his inauguration in March of 1933 brought about some hope. In the first "hundred days" many "alphabet" organizations of the New Deal were established. Roosevelt called the combination of these programs and organizations "A new deal for the American people." (Graham and Wander, 1985, p. 265)

F.D.R. wanted to do three things immediately: 1) to relieve the burden of unemployment and poverty, 2) to start economic recovery, and 3) to implement economic and social reform. Roosevelt felt that relief from The Depression was the federal government's responsibility. He believed that in order to accomplish his goals experimentation was appropriate. The government should try new programs, and if they didn't work, discard them and go on to another experiment. In order to convince people that what he was doing would help, he needed information offices to educate people. The U.S. Film Service was first established under one of these information offices in the Resettlement Administration. (Graham and Wander, 1985)

After a relatively smooth first term, Roosevelt ran into trouble during his second term. The Supreme Court, which was controlled by Republicans originally appointed by Hoover, declared the National Industrial Recovery Act unconstitutional. This judgment had far reaching effects on the New Deal including The Film Service. The decision held that the act was an improper delegation of legislative power and improper regulation of interstate business. In addition, that same year the Court invalidated the Agriculture Adjustment Act of 1933. Roosevelt, who was buoyed by his landslide victory in the election of 1936, proposed a law which would appoint additional justices, increasing the number up to 14 for those who reached the age of 70 and who did not retire. This bill alienated many legislators, both Republicans and Democrats, especially Southern Democrats. (Graham and Wander, 1985)

Another mistake by F.D.R. was the proposal of The Reorganization Bill of 1937 which was perceived by some legislators as Roosevelt's attempt to become "king." The act put more control of administrative agencies into the executive branch of government . In 1937-38 a downturn in the recovery caused a recession. Both the Supreme Court and The Reorganization bills failed and by 1939, when Roosevelt did get a reorganization bill through Congress, the New Deal was fading and war was quickly approaching. (McElvaine, 1984)

Another factor in the politics which would eventually affect The Film Service was the factionalism within the Democratic Party which came about after the landslide for the Democrats in 1936. Many Democratic Congressmen resented the implication that they "rubber stamped" legislation proposed by Roosevelt. Many were jealous of the growth of the presidential power under Roosevelt. Many in the party believed that Roosevelt would not run again so there was no reason to support him. The party had also been transformed during his administration from a group of rural Southerners to one of Northern urbanites including a large labor union constituency. (McElvaine, 1984)

McElvaine (1984) and others speculate that putting "band-aids" on problems without any real social reform had not changed the roots of the problem which caused The Depression in the first place: Americans were still ill-housed, ill-clad, and ill-nourished. The military build up, the American people's concerns about the potential war, and Roosevelt's preoccupation with international events changed American thought.

The social and economic reform organizations of the New Deal did create a wonderful arena for artists of the period. The government subsidized photography by Arthur Rothstein, Dorothea Lange, and others; music by Woody Guthrie; and documentary films by The Film Service.

Documentary Films

For years, the government under the auspices of several agencies had produced films. The Army Signal Corps filmed the Wright Brothers' flight at Kitty Hawk. In 1912 the Civil Service Commission made a film called *Won Through Merit* about the government merit system. The Interior Department had a program which was largely advertising, mostly for the purpose of telling the public about the activities of the department. It made films about Indian reservations, and for the Bureau of Reclamation (Boulder Dam and Grand Coulee Dam). The Office of Education was under the Interior Department at this time (1930's) and it produced many "instructional films." The Interior Department's Division of Motion Pictures in the '30's produced about 25 reels per year. A few other government films were produced as sponsored films: they were paid for by Westinghouse, Sinclair Oil, U.S. Steel, General Motors, Standard Oil, and Ford. (McCann, 1973)

Into this world of government documentaries came a film critic and artist, Pare Lorentz. He was born (1905) in Clarksburg, West Virginia where his father was a college professor. His mother introduced him to the arts, especially music. He went to the University of West Virginia where he wrote for the school newspaper and was the editor of a satire magazine. After college, he moved to New York and began writing film criticism for *The Judge*, *Vanity Fair*, and eventually *McCall's* and other magazines. He got involved in other artistic genres and married an actress, Sally Bates. He wrote a book, published in 1930, with a civil libertarian attorney named Morris Ernst, titled *Censored: The Private Life of the Movies*. It was about the social role of the movies in America. In 1933 Lorentz published a book titled *The Roosevelt Year: 1933*. He had originally wanted to make it into a movie but could not secure the funding so he turned it into a photo book with accompanying prose showing the harsh realities of The Depression. He was offered a job as a political columnist for King Features, part of the Hearst Corporation. His column called "Washington Sideshow" did not last long. He was fired personally by William Randolph Hearst for praising the New Deal farm policies in his column. (Barnou, 1974)

The Resettlement Administration

The Resettlement Administration (R.A.) was created by executive order on April 30, 1935 and Rexford Tugwell, Undersecretary of Agriculture, was appointed administrator. It was established as a farm relief agency and got its money from the Work Projects Administration (WPA). The R.A. was an "action" program. Resettlement was the removal of farmers from their Dust Bowl depleted farms and relocation to other land with better opportunities. From the beginning the agency was unpopular, so Tugwell set up a public information network to subdue criticism. Resettlement had to be explained to "the people." The mission of the information staff was to tell the story of the problems faced by the Resettlement Administration and Tugwell planned to use films to help distribute information. (Snyder, 1968) If a government agency wanted to make and use films there were two paths available.

Two Paths of Government Films

Until this time, government agencies followed one of two paths in making films: an agency would hire outside companies or they bought their own equipment and proceeded from there. Tugwell, felt that outside companies could not do what he wanted; he also believed other government film units (the Department of Interior, for example) were inadequate. He chose to create his own film unit. (Mercey, 1940)

Rex Tugwell and Pare Lorentz

Lorentz was hired because of his writings which supported the New Deal; he had never made a movie. Tugwell hired him in June of 1935 primarily because Lorentz wanted to make quality motion pictures--aesthetically pleasing and yet commercially distributable. "The people" had to see what the government was doing to help. Tugwell liked the idea because a film which could be distributed commercially would reach more people. Lorentz was convinced that the government could make quality films and should accept responsibility for producing films which dealt with major contemporary problems in which Hollywood showed no interest. He said he could make the film which The Resettlement Administration wanted for $6,000; in September of 1935 he hired his photographers, Ralph Steiner, Paul Strand, and Leo Hurwitz.(Barsam, 1973)

The Plow That Broke The Plains

From the beginning of the project Pare Lorentz had problems. The first problem evolved out of the use of "relief money" for making films. To clear the path for making a film within an .information office of a relief agency, Arch Mercey, assistant director of information for the R.A., had asked the Comptroller-General of the U.S. for an opinion on the legality of using Resettlement Administration money for making a movie. In the letter to the General Accounting Office, the Comptroller-General responded favorably; that is, he felt the monies could be used to make films. (McCann, 1973) Because the Comptroller-General is not a lawyer, his opinion might have been suspect. The issue of using relief money for "information" in general, and movies in particular, became the major impediment for The Film Service.

Lorentz also had trouble with some "red tape" in Washington. Because he was unfamiliar with the reimbursement procedure, he got some receipts which could not be honored by the General Accounting Office. One receipt was written on a paper bag which he received when he paid two farmers for the use of their wagons in the film. (Snyder, 1968)

Another problem was with Hollywood producers who, after learning of his movie and finding out that it was government sponsored, refused to give him some "stock footage." It was a common practice to sell "stock footage" to anyone willing to pay. His friend, King Vidor, interceded on his behalf. (McCann, 1973)

Lorentz shot the footage he needed of The Dust Bowl, he had gathered "stock footage" from Hollywood, and he had acquired some World War I film from the U.S. Signal Corps in New York. He was ready to begin assembling the film. He had never edited a movie. He hired some "girls at the lab" to show him how to edit. He then hired Virgil Thompson to write the music. Thompson incorporated many folk music themes into the composition. *The Plow That Broke The Plains* was the first film produced, directed, and written by Pare Lorentz. The cost was slightly over $19,000. It was a film about the destruction of farmland, the causes of The Dust Bowl, and what the government was doing about it. (Snyder, 1968)

Distribution of *The Plow*

Because of the earlier problems with Hollywood, Lorentz feared he could not get *The Plow* distributed. His plan was to get Roosevelt to view it and he hoped that a presidential screening would be the impetus for wide distribution. The premier of *The Plow That Broke The Plains* was on a Sunday evening at the White House in March of 1936. Roosevelt liked the film and his support spurred Lorentz to set up a screening for several Hollywood producers including King Vidor. From that showing Lorentz was further encouraged to distribute the film commercially. (Snyder, 1968)

The first public showing was in Washington and the reviews were positive. However, by May 1936 the positive support had disappeared and the film was characterized in other venues as propaganda. Distribution became a nightmare when on May 18, 1936, the Supreme Court ruled the Resettlement Administration unconstitutional. Many Hollywood distributors may have used the unconstitutionality of the R.A. to keep from distributing the movie. (Snyder, 1968) A distributor who declined to show the film said, "If any private company or individual made this picture, it would be a documentary film. When the government makes it, it automatically becomes a propaganda film."(Snyder, 1968, p. 44) One distributor replied to Lorentz's question about his objection to the content of the film, "...it is government competition with Hollywood." (Snyder, 1968, p. 45) The eight largest booking firms refused to distribute it. Lorentz did get it shown in New York at the prestigious Rialto Theater, owned by Arthur Mayer who used Hollywood's intransigence as advertising: "Hollywood says thumbs down!" "The picture they dared us to show." (Snyder, 1968, p. 48) The New York reviewers liked it, too. (Snyder, 1968)

Lorentz's "Resignation"

Because of the inordinate amount of problems: financial, government red tape, and Hollywood's resistance to government films, Lorentz went to Rex Tugwell to resign in June of 1936. As he was leaving after resigning, Lorentz saw a map of the Mississippi River hanging from the wall. With his index finger, he traced the drainage from the head-waters of the Missouri to the Gulf of Mexico and said, "Rex, here is the great picture that ought to be made..." He then left the office. Tugwell ran after him and said, "Pare, we'll do it." (Snyder, 1968, p. 71)

The River

The Story of the making of *The River* is much like the story of *The Plow That Broke The Plains:* a quality film produced on limited funds, in the midst of government controversies and Hollywood fears. In spite of these obstacles, some critics feel that *The River* is the best documentary film of all time. While Lorentz was trying to distribute *The Plow* he was also trying to write *The River*. By the time *The River* was completed the Resettlement Administration had been incorporated into the Farm Security Administration, a part of the Department of Agriculture. (McCann, 1973)

Roosevelt had set aside $50,000 in an executive order for the making of the movie. It was to be a film about the causes and dangers of water erosion. Most of the filming was done in the summer of 1936 through January 16, 1937. Shortly after the crew broke up, it looked like a major flood was coming down the Ohio River and Lorentz called his photographers to Memphis to start filming the flood. Lorentz had planned to include floods in the film and this major flood of 1937 was to provide powerful footage for *The River*. After gathering the footage, Lorentz returned to New York to cut and assemble. He used another original score by Virgil Thompson. Lorentz wanted to show how water moves from a single drop of water to become the powerful Mississippi and how runoff is a problem, washing tons of topsoil into the Gulf of Mexico every year. The second theme of the movie was to demonstrate the close relationship of land, water and people. (Snyder, 1968)

Lorentz used an innovative method of editing. He assembled the film, dubbed the music, and finally, added the narrative. The narration was poetic and used repetition as a tool to reinforce themes. The lyrical version of the narration was published in *McCall's*, and 150,000 requests for copies were received. (Snyder, 1968)

When the film was finished in September of 1937, it was shown to Roosevelt, this time at Hyde Park. The President is quoted as saying, "Magnificent! What can I do to help?" (McCann, 1973, p. 75) Tom Corcoran, F.D.R.'s aide, was called in at once and shortly after, a plan was conceived by Corcoran and other aides for a permanent U.S. Film Service. In addition, Lorentz had a series of meetings with Barney Balaban, chairman of Paramount Pictures, who agreed to distribute *The River*. (McCann, 1973)

Distribution of *The River*

The first public showing was held in New Orleans on October 29, 1937. Showings were held in cities along the Mississippi: Memphis, St. Louis, St. Paul. The reviews were positive. (McCann, 1973) Letters came from distributors praising it. However, there was still resentment from Hollywood. Because *The River* did not fit any of the existing categories it was not nominated for an Academy Award. (Later the Academy changed the categories to accommodate feature length documentaries. *The River* is 32 minutes long.)(Blakefield, 1980) After some diplomatic wrangling, *The River* was entered in the Venice International Film Festival of 1938 where it won first prize. Now the films of Pare Lorentz were internationally known. (Snyder, 1968)

The U.S. Film Service

When Roosevelt and Corcoran saw *The River* at Hyde Park, they instructed Lorentz to set up a plan for The Film Service. It was organized under the National Emergency Council, another organization wholly supported by relief funds. One reason to establish the film service away from the Farm Security Administration, where Lorentz had made *The River*, was because the General Accounting Office took exception to the use of funds appropriated for relief purposes in the distribution of the film. Agency consolidation was taking place in the Department of Agriculture with information officers meeting every week to coordinate efforts. There was a great deal of poor public relations over the use of the information services for Roosevelt "propaganda." A furor arose because of the overhead of the Farm Security Administration. Appropriation hearings in 1937 for fiscal 1938 were especially hostile in regards to new funding: How much went to relief and how much went to overhead like films? (McCann, 1973)

The U.S. Film Service was created in September 1938 with Pare Lorentz as director, Arch Mercey, Assistant Director, and Floyd Crosby, Director of Photography. Its purpose was: "To acquaint federal and state agencies, educational institutions, and interested civic organizations and groups with the availability of silent and sound motion pictures produced by government agencies. A consultation service is maintained, and visual educational study aids for classroom and adult education may be obtained upon request." (U.S. Government Manual, 1938-39, P. 389) In a public relations move suggested by Roosevelt, the Film Service became a distributor of films as well as the favored role of producer of films. Roosevelt must have foreseen the political battles which a government film production company would have to fight. Lorentz was adamant about continuing production, but he knew that these productions would have to be paid for by other agency funds. The Film Service had no funding of its own.

In nine months The Film Service was transferred to a new federal agency, The Federal Security Agency, as part of the Office of Education. Prior to this time, the Office of Education had been a part of the Interior Department. Roosevelt's second plan to reorganize the executive branch, The Reorganization Plan of 1939, abolished the National Emergency Council and placed The Film Service and Radio Service in the Office of Education. (McCann, 1973)

Financial support for The Film Service had always been tenuous. And when the House

Appropriations Committee for 1939 adjourned, it had specifically denied The Film Service permission for funds. However, it was suggested in the Office of Education that The Film Service carry on as it had in the past, that is, to use other agency funds. In addition, many Congressmen realized that they had already appropriated funds to agencies which would spend that money on films to be produced by The Film Service. Many people within The Film Service, Lorentz included, felt that Congress's suggestion to use other agency funds to produce films was tacit approval to do so. (McCann, 1973) The Film Service prepared a defense later before the Appropriations Committee of 1940 which stated that it wanted to centralize and thus economize film production by other agencies. It seemed apparent, though, that expansion of production was its main goal. This battle for appropriations was temporarily resolved in 1939. The Film Service decided to use the existing procedure, i.e. The Film Service would get its operational funds from other government agencies.(Mercey, 1940)

Other Motion Pictures Produced by U.S. Film Service

Technically speaking, *The Plow That Broke The Plains* and *The River*, although produced by Pare Lorentz, were not produced by The U.S. Film Service. They were produced within the information offices of relief organizations. Because The Film Service lasted only a short time, only one film was completed by the organization, *The Fight For Life*. Two other films were begun by The Film Service, and later, after its dissolution, were completed by other government agencies: *The Power And The Land* and *The Land*.

The Fight For Life

Paul deKruif, a noted writer and physician, donated the rights to any of his books to be used in making government movies on one condition--Pare Lorentz must direct them. Hollywood was bidding for the rights to deKruif's novels which many producers wanted to make into commercial films. However, deKruif had seen *The River* and felt that Lorentz could make his movies more realistic. At this point Lorentz had not found a sponsor for *Ecce Homo!*, a radio show he wrote for CBS and which he wanted to make into a movie. Lorentz decided to produce *The Fight For Life*. (McCann, 1973)

The filming took place in Chicago. It was to be a film about a maternity center, malnutrition and big city slums. The movie included four professional actors and could be considered the first "docudrama." It was 70 minutes long and was given to the Public Health Service for distribution. Once again music was an important part of the film including Louis Gruenberg's score, and an improvised jazz piece during the "night walk scene." Lorentz felt that the photography by Willard Van Dyke was better than anything done before this time. (Snyder, 1968)

Snyder (1968) and McCann (1973) speculate that Lorentz was no longer intent on trying to please Congress, but rather, he was intent on impressing the film world. The film was shown to FDR on New Year's Eve, 1939 and ready for distribution in April of 1940. The government accepted bids for distribution of its first "commercial" film. Columbia won the contract. The government was to get 25% of the gross sales. (Snyder, 1968) Once again, the film created controversy. One Congressman later said, "You'll scare women to death." Another asked, "Why should the public know this?" (Snyder. 1968, p. 120) Some doctors accused the film makers of using inaccurate statistics. The controversy revolved around the depiction of slums and people eating out of garbage cans. It portrayed the hazards of pregnancy given the inadequate diets of poor women. It was banned in Chicago where it had been shot because it showed the city had slums.(McCann, 1973)

The Land and *The Power And The Land*

Simultaneous to *The Fight For Life*, The Film Service accepted responsibility for producing other films for government agencies. It started *The Power And The Land* for the Rural Electrification Administration. This film showed how rural electrical cooperatives could help farmers. Lorentz brought in Joris Ivens, a Dutch documentary film maker, to direct the film. At the same time The Film Service had started *The Land*, directed by Robert Flaherty who had been in England but returned to work for Lorentz. Flaherty was the most famous documentary film maker of the period having made many documentaries including *Nanook Of The North*. *The Land* was made for the Agricultural Adjustment Administration. (Snyder, 1968) Lorentz pushed for *The Power And The Land* to be completed prior to the Appropriations Committee Hearings in February 1940. He wanted to use this popular topic, rural electrification, as a selling point for The Film Service and their proposed budget of $106,400 for fiscal year 1941. (McCann, 1973)

Neither film was finished before the end of The Film Service. It went out of business by August 1940 and the films were completed after that by their respective directors. *The Power And The Land* had its premiere on August 31, 1940 in St. Clairsville, Ohio, the home town of the family whose farm was electrified in the movie. The New York showing was at the Rialto on December 10, 1940. *The Land* took longer to complete with Flaherty working on it in cooperation with the Department of Agriculture. The premiere was in New York at the Museum of Modern Art in April 1942.(McCann, 1973)

In spite of the quality of these films, The Film Service was headed for trouble and eventually its demise.

A Battle For Autonomy

Since its transfer to the Office of Education, The Film Service had been engaged in other activities: cataloging, public relations, and distributing government films. It had also done some consulting. The Film Service had never been given any money directly; it had relied solely on other governmental organizations, most notably relief agencies and the President, for its operational funding. In 1940, for example, the WPA had allocated $162,500 to support *Ecce Homo!*, the abandoned Lorentz film, as well as the distribution work of The Film Service. They also contributed $75,900 for *The Fight For Life*. An equal amount was given by the Public Works Administration and $16,700 was given by the Farm Security Administration. The Joris Ivens film, *The Power And The Land*, and Flaherty's film, *The Land* were paid for on a reimbursable basis from the Department of Agriculture; that is, the Department was to be repaid from commercial distribution revenue.(McCann, 1973) The Film Service felt it was time to apply for its own funds.

John Studebaker, head of the Office of Education, submitted a budget proposal of $106,400 for The Film Service to the House Appropriations Committee for the second House Hearings on Appropriations of 1940 (for fiscal year 1941). In retrospect, The Film Service might have survived until the War had it continued to exist on funds of other agencies.

The question of legality arose again. The Committee requested a legal opinion regarding the Office of Education producing films from the Federal Security Agency legal department. Its opinion stressed the last clause of the Act of 1867 which established the Office of Education. Here was the justification for making films: "...and otherwise promote the cause of education throughout the country." (McCann, 1973, p. 106) The House Committee did not agree. "Otherwise promote" was not enough justification to warrant a film service. The committee's report reads, in part, "The committee, after consultation with parliamentary authorities, has concluded that there is at the present time no existing law that would authorize the carrying on of these services. The sums named have been eliminated from the bill." (McCann, 1973, p. 106)

Senate Hearings

Studebaker then sent his proposal to the Senate. A subcommittee heard the case in April 1940. Kenneth McKellar (D., Tenn.) argued that the need for a film service was "...unwise, not justified by the law, and futile."(McCann, 1973, p. 106) McKellar felt that the use of relief funds for making government films was inappropriate. "No provision is made there (in The Emergency Relief Act) for making moving pictures, and whoever gave you that relief money for that purpose undoubtedly violated the law, and you gentlemen (Lorentz and Studebaker) in accepting it have undoubtedly violated this law."(McCann, 1973, p. 106)

There were four reasons for the failure of the appropriations to get through committee. The first reason was that The Film Service's existence was tentative, based on doubtful legal status, i.e., the Law of 1867 which established the Office of Education. Second, Congress had established a general prohibition against allocation of relief funds to be used by information offices. This prohibition had been sidestepped by The Film Service because of the Comptroller-General's ruling that informational services were legal under relief funds appropriations. Third, it probably seemed obvious that Lorentz's primary objective was to produce films, yet The Film Service claimed that it was serving "economy" by wanting to consolidate all the film units within the government. Finally, several Senators felt that *The Fight For Life* was an expensive redundancy. There was an "informational film" on prenatal care available through The Labor Department which would have "...worked as well, served public relations and cost less." (McCann, 1973, p. 106)

One Last Chance

After the appropriations had been rejected in committee by both the House and the Senate, Senator Elmer Thomas (D., Okl.) "tagged" an amendment to the Federal Security Agency Appropriation Act. This amendment inserted the original budget ($106,400) for The Film Service as a "rider" under this important Labor Department Appropriations Bill. Thomas contended that the legitimacy of The Film Service was covered by the Office of Education's enabling Act of 1867. He claimed that many other agencies in government worked through information offices. This argument did not convince those who believed The Film Service produced "propaganda" for The New Deal. (McCann, 1973)

The full Senate defeated the "rider," and the House Appropriation Committee wrote a resolution which was specifically designed to eliminate future appropriations for The Film Service and coincidentally The Radio Service.

> "Except as authorized in this joint resolution, no allocation of funds shall be made to any other Federal agency from the appropriation in this joint resolution for any Federal agency. No such allocation shall be made for the exercise of the functions of the Radio Division or The U.S. Film Service transferred to the Office of Education of the Federal Security Agency." (McCann, 1973, p. 107)

This resolution brought about the end of the debate and the end of The Film Service. It could no longer survive from other agency funds; that course of action was specifically prohibited.

Summary

Perhaps the real cause of the downfall of The Film Service was that it produced quality films. By making good films, The Film Service created a "high profile" organization. Had it continued the tradition of government "instructional films," it may have survived. When its notoriety increased so too did its enemies. In the end The U.S. Film Service lacked friends. Its demise evolved out of three overlapping enmities: Presidential politics, unpopular alliances, and conflicts with powerful Hollywood lobbies.

Presidential Politics and The Film Service

Politically, the major conflict was a traditional one, the conflict between the Executive Branch and the Legislative Branch. Roosevelt loved movies; in 1938 his son, James, went to work for Goldwyn Productions as a film executive and later started his own film company, Globe Productions. Many Congressmen, especially Southern Democrats and Republicans, opposed what they perceived as Presidential publicity. Every new agency had an information office. These "enemies" saw Lorentz's films as positive publicity for the President and his programs.

Toward the end of Roosevelt's second term, after the recession of 1937-38, the government was being consolidated and this change required fiscal restraint and justification. Along with this restraint came an alignment of Southern Democrats who wanted a more conservative approach to the Presidency. They did not interpret information, e.g. films, as an executive tool, but rather as propaganda. The power of information seemed to be held by the executive branch at this time and Congress resented it. Additionally, this was one program where Democrats could show they did not "rubber stamp" all of Roosevelt's legislation. Another political factor was the unwieldy budget procedure. One person could control the process in committee. Finally, some Congressmen felt that the relief money going to produce films should be going to the people who needed it.

Unpopular Alliances

By the late '30's the New Deal was fading into a time of prewar economic growth and the need for "information services" was not felt as much, although that need would soon be important with America's involvement in the War. There were personality factors underlying the fall of The Film Service. It was aligned with several unpopular relief organizations which were administered by strong, intelligent men committed to the New Deal. Henry Wallace was Secretary of Agriculture from 1933 to 1940 when he ran as Roosevelt's Vice President. Originally a Republican, he advocated farm reform and support for the rural poor. Later he became an advocate for industrial workers and full employment. He alienated Republicans for his cross-over and later alienated early Democratic supporters by turning away from the rural poor to support urban unions. (Graham and Wander, 1985) Most financial support for The Film Service came from relief agencies within The Department of Agriculture.

The Resettlement Administration, a relief organization which supported the production of *The Plow*, was an agency in the Department of Agriculture. The R.A. was administered by Rexford Tugwell. He was a strong believer in Government intervention in economic policy to achieve balanced production and mass consumption. By the spring of 1934 he had become controversial and a prime target for opposition press, especially because of his connection with a pure food and drug bill introduced in 1933 which was vigorously opposed by manufacturing and advertising interests. "The New Deal veered away from holistic planning after 1935 and moved toward the antitrust, antibusiness New Freedom thrust of the Second New Deal... Increasingly the target of denunciation in the media and among New Deal critics as 'Rex the Red.' Tugwell kept a low profile through the election year of 1936 and resigned the next year." (Graham and Wander, 1985, p. 430)

Roosevelt's bill to change the Supreme Court and his two reorganization bills not only hurt him politically, but also hurt organizations closely allied with the executive branch, especially when it came time for appropriations. Those Congressmen who wielded the "power of the purse" finally had a way to curb the President's power.

Hollywood and The U.S. Film Service

The problems with Hollywood may seem superficial when compared to the financial, cultural and political problems The Film Service had to face. The reality of having to face those obstacles which Hollywood created in addition to the lack of money and the political opposition made Lorentz's job more difficult.

The Depression had an effect on the behavior of Hollywood producers and their feelings about the government making films. Although the film industry was not interested in making documentary films, it eventually made some war "propaganda" films toward the end of the '30's. (Snyder, 1968)

By the end of 1930, four companies (Paramount, Fox-Loew, Warner Brothers, and RKO) owned a total of 2,500 of 3,000 movie houses in the United States and Canada. This was nearly all the first run theaters at the time. (Jowett, 1976) It was difficult to get an independent film distributed. In addition, the government was trying to get the industry to divest themselves of theater ownership through antitrust action in the '30's. This government action alienated some producers. While the coming of sound did stave off financial disaster for the Hollywood studios, "...never again would the American film achieve the absolute popularity it claimed in 1930, when there was an average of three attendances per week for each American household." (Jowett, 1976, p. 197)

Government films didn't seem to be a problem for Hollywood until the government started making good films under Lorentz. DeKruif's gift of the rights to his books angered those Hollywood producers who were bidding for them. *The Fight For Life* must have scared Hollywood as well, not just in its quality, but because Lorentz was hiring professional actors to perform in his "documentaries." The logical next step in the producers minds could have been the government producing full length feature films, i.e. getting into the entertainment business.

Finally, there was a strong conservative lobby in the form of the Motion Picture Producers and Distributors of America (MPPDA), called the Hays Office. Originally set up to combat federal censorship, to involve the public, to self regulate, and to improve relations between various sectors of the industry, it became a very powerful force in the film industry for 25 years and it had powerful connections in Washington. (McCann, 1973)

Hollywood's resistance to The Film Service was understandable given the economic conditions. However, the rejection of a film simply because it was made by the government and labeled propaganda was an indication of the historical period as much as a reflection of the film industry. Although The Film Service did not survive, in the years immediately following its 1940 demise, the Government had a tremendous impact on the film industry. There were countless "training films" produced by Hollywood and directors like Frank Capra made war "propaganda" movies. (Blakefield, 1980)

Conclusion

The rise and fall of The United States Film Service was not a simple conflict between Congress and agency administrators appointed by a popular President. It had a five year history of holding on by its financial fingertips. Although the need may have existed for a service to distribute information via films (the need became far more obvious to Congress during the War years,) politics, poor alliances and Hollywood jealousies eroded its foundation. That foundation was the exceptional films it produced.

Opposition was strong because of its birth among F.D.R.'s alphabet agencies and because it had survived by covertly using relief funds. It would be easy to second guess the procedures and choices used in the fight for establishing a permanent film service, but given the environment in which these film makers worked, the product speaks well for the artistry and stamina these men possessed. The Film Service has left a wonderful legacy, its five documentary films: *The Plow That Broke The Plains*, *The River*, *The Fight For Life*, *The Power And The Land*, and *The Land*.

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A Visual Evolution

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Why Paint?

What compels one to paint, especially when so many other forms of expression, both visual and otherwise, are available; forms that are more social, more widely appreciated and commercially viable; and less esoteric, personally demanding, and utterly terrifying? The development of a unique imagery makes many demands, but at the bottom line, it seems one must have a passionate love for the entire world of visible and visual experience; and also a personal necessity to express something that can be presented no other way. By facing the easel every day—to render in color, form, and space, something I could otherwise never know or anticipate—is, for me, something of a mandate, the source of which I simply do not know. This driving impulse is so elusive that there are times that I question my sanity in continuing to give in to it. Yet, through painting I am able to come to know what otherwise could be neither discovered nor articulated. It enables me to contact an inner reality that is central to being in the world.

The terror. With each painting, there is risk, danger, entry into an uncharted world. No matter the degree of confidence, beginning a painting always feels as if I have fallen into the middle of an ocean. No land in sight, no way to know whence the closest shore, nor what currents and storms will be encountered enroute to safety. But I've become a strong swimmer, have endured a multitude of unexpected rough seas, contrary currents, real and imaginary encounters, and have made it to shore so far. . . .

Paintings Speak

When people see my paintings, almost always of nudes, they are struck by the boldness and the eroticism: surface imagery and superficial appearances. Thus some consider my work an invitation for a sexual pass. Others, because I paint mostly women, think I must be lesbian. Even the male nudes are often perceived as female. When I point out the penises, viewers are dismayed, revealing much about our sexual conditioning. From art history we know female nudes as depicted by male artists, infused with Eros: desire, lust, and projection of male ideals of female physical perfection.

Historically male nudes are active, conquesting, confronting a challenge. In my paintings men, like the women and children, are pensive, reflective, tender, and vulnerable. I am more interested in who they/we are than what they can, or do, do. I wonder whether, given the perspective of a few years hence, a difference in how women depict the nude will be discernable? Or whether a nude is a nude is a nude, and however it is interpreted is in the eye of the beholder more than the artist. We see what we want to see.

Although I'm living and creating in a charged and rapidly changing time, I am not particularly attracted to politics, polemics, and doctrines, as I've found them more restrictive than growthful. A leader or a follower when necessary, I am mostly an explorer: one willing to enter uncharted paths that beckon or come my way; to respond totally and authentically to challenges; letting a combination of intuition, logic, inner resonance, and truth, when discernable, be my beacons and guides.

Therefore, I don't try to make a specific feminist or female statement about painting nudes, but being a liberated and gutsy woman, there are qualities in the paintings some may perceive as polemical. That most of us are belabored by associations and/or hang-ups is not a problem for me to solve or even address. I paint nudes because they are the most fascinating and challenging subjects I have encountered or can imagine. Models are inspiration, not objects of investigation. I don't try to depict him or her as a person or personality; nor do I try to capture the wondrous universe of skin tones or subtle individual nuances of forms and shapes. Over the years I have developed a fairly accurate eye, and can draw or paint, with exacting realism just about anything, if I so choose and apply myself. The fact is, I find realistic representation an unqualified bore, and am endlessly thankful to photography for relieving artists of the tedious responsibility of documentation. My quest is for a personal and unique visual vocabulary that is informed by both the expressions of the past and the trends of the present, while being shackled by neither.

Student Years

A memorable event that profoundly affected my vision and way of working, was learning to use a camera and the darkroom. For all I knew, a darkroom was genuinely *dark*, and photographs were somehow slapped onto paper by a machine, totally unseen by the human eye. My amazement, as I watched the image slowly emerge in the developing tray, was profound. In the 1980s, thanks to computer graphics and television, evolving and changing visual forms are an everyday occurrence. But thirty years ago, aside from a few fades in films, I had never experienced anything remotely like the magical occurrence I saw that day in the developing tray. In all that I have done since, in whatever medium, the process of pulling an image out of the format—whether paper, canvas, sculpted form, and even written works—rather than plastering it on, has been central to my vision and work.

Coming from a liberal arts background that included studies of mathematics, logic, and philosophy, I was surprised to feel as if I was *really* thinking for the first time when studying Josef Albers' Interaction of Color at Yale. The joy and challenge of pure visual thinking, together with the lusciousness, richness, variety, and subtlety of color, was my initial seduction into painting, and remains a significant reward to this day.

In my student years I was also in love with abstraction; and quite frankly, I really didn't know how to draw: to either represent with confidence or express with vision. Discovered by one of my teachers to be temperamentally suited more to painting than to a program in graphic design—based upon the compositional and color sensitivities I had evinced, and by my expressed horror at anything remotely commercial—I was encouraged to major in painting, and forced to learn to draw. Learning to draw in my 20s, together with subsequent teaching experience, has convinced me that the ability to draw is, and can be, learned.

While studying drawing, I was introduced to the figure, another significant catalyst. My initial encounter was so powerful that I knew instantly I would never tire of the human figure as the most varied, challenging, and expressive form available in visual imagery. An ultimate.

While arduously and devotedly coming to terms with the figure in drawing, I continued to paint abstractly. There was something about involvement with the gesture and substance of paint that, while initially glorious, eventually came to feel, by itself, inadequate. From a purely visual viewpoint, I love the freshness, exuberance, and freedom of non-objective abstraction, where formal considerations of composition, and relationships among the elements, are in unadorned evidence. But in my own work I hungered for an imagery that was more topical, more content-significant. In losing sight of human experience, concrete or metaphoric, the threat of slipping into a chasm of unlimited possibilities, overwhelmed me. The intrinsic reliance upon serendipity in my early abstract efforts, quickly felt like a ritual, a supplication that seemed to glorify an essentially masturbatory act rather than engage me mind, body, and soul.

On My Own With Models

Years intervened: I worked in city planning and urban renewal to discharge student debt and gave birth and cared for two children, during which time I painted derivative geometric abstractions that could withstand a mother's frequent interruptions. Then, one day, I hired a model to come to my studio and pose. Fortunately, she was as inexperienced as I, totally devoid of pretense or prior expectations, and we clumsily set to work. As *my* knees were shaking, I urged *her* to sit down in a nearby chair, and accepting the pose as is—gripping the sides of the chair with both hands—I set to work drawing directly on a primed canvas. Within moments I was in the altered state of consciousness that is central to drawing, the fears and awkwardness dissipated, as I concentrated on the relationships of forms and contours in space. At the same time, I was aware of having stepped onto a path that was firm and resolute underfoot; a sensation unknown to me in my wandering, searching life theretofore. As she and I continued to work together in the months that followed, the feeling that I had connected to a power greater than myself, to which I could only be accepting and reverent, continued to grow. Anyone who knew me well was aware of the transformation, the shift in beingness and priorities.

With models I make an effort to shelve my natural impatient bluntness and be more gentle, unrushed, understanding, and accepting; to create an atmosphere that is safe and professional for them to expose themselves. Most feel fairly comfortable, or at least accustomed, with the process of disrobing and posing, and some are attracted by the possibility of the immortality it might provide. I'm not too promising on that score because it's the essence of humanness I endeavor to depict, not the personality or likeness of a specific individual; hence, in my early works, the featureless faces. When I first painted faces, they were too compelling, too riveting, raised too many questions about the individual, so I painted them out, and left them blank for several years.

Who are we at the very core of our being, without masks, roles, or costumes, is what I want to know, what I want to depict. Montaigne has said that each of us contains the whole condition of humanity. What are the central responses to existence, to experience, to relationships? Can archetypal essences be meaningfully expressed visually? If I should find such imagery, will it be recognized?

At our first session, I tell the model how I work, what to expect, how long the pose is likely to last, and how I like her or him to move slowly and improvisationally while I look for a challenging and interesting pose, one that seems to capture an evocation of his or her beingness. Ideally, models are willing to bare themselves emotionally as well as physically, so I must be emotionally and artistically responsive, available; able to transform our interaction into something expressive and palpable through the elements, principles, media and techniques of drawing and painting. I may initiate the contact, but the best models take up the ball and become a catalyst, draw feelings and experiences out of me that alone would remain elusive. Thus we embark on a collaborative quest for emotional and psychological truth; an evocation of one soul making contact with another. What forms this takes always remain to be seen.

Music and Dance

Both music and dance are strong influences on my work. During college, and for twelve years after, I studied modern dance. I still attend a dance class once or twice a week, for it provides a way to maintain awareness of my own body, my personal physical presence in the world. Such sensitivity and awareness is crucial to me as a painter of the human figure, for it enables me to empathize with my models, to feel their pressure points, strains, and torques. When I draw them, I am them. As one who studied classical music from an early age, and sang professionally for fifteen years so to partially support my painting, I play music to embrace our modeling sessions with nourishment and inspiration. It fosters a shared aural atmosphere where the model and I endeavor to establish an empathy, temporarily become one.

Techniques

Coating canvas with an isolating and protective coat of gesso, is a carry-over from ancient painting techniques when it was imperative to isolate canvas from oil paints because oil, never chemically stable, eventually rots the canvas. Because acrylic medium serves not only as a binder of the pigment, but also as a chemically inert isolator of the canvas, I realized I could stop gessoing altogether, and work directly with acrylics, both thinned and translucent, and thick and opaque, on unprimed canvas, both cotton duck—which because of its relative whiteness gives a greater luminosity to colors—and linen.

One summer I went to the Far East to study Chinese ink painting, and it's a good thing, for if anything requires the pure consciousness, the inner stillness of a Chinese mystic or Zen master, it's staining into unprimed canvas with permanent acrylic paints. The margin for error is virtually nil, because the thirsty fibers absorb the liquified paint instantly. While some layering is possible, from light to dark, too many layers, that become unintentionally opaque, can die. Translucent colors, on the other hand, breathe with vitality, glow with an inner light. Inspired by the many incredible Oriental paintings on silk that I studied, I returned home with as much natural silk as I could locate, and it too has been a delicious support for my visual explorations.

Whatever the material, the canvas is in evidence in my paintings, as texture, color, or both; in some instances so strongly as to appear in front of the image. Historically, this phenomenon has been considered a fault, but I have chosen to achieve it deliberately; to enhance that feeling/experience of seeing beyond/into another world.

Teaching Art

When I began teaching drawing and painting in the studio program at the Philadelphia Museum of Art, I was struck by my students' inability to articulate visual experience. Word and image seemed more in conflict than as two cooperative realms of inquiry. Thus began my research into what I eventually learned to be a significant part of visual literacy. My attempts to develop a course (at Temple University), and later to write my book, *Introduction to Visual Literacy, A Guide to the Visual Arts and Communication* (Englewood Cliffs, NJ, Prentice Hall, 1987), were mutually reinforced by, and reinforcing of, my work at the easel. It awakened me to the gap between intent and message, and influenced me to be more accepting of interpretations and interpolations.

The many ramifications of visual literacy continue to empower all my studio and classroom work, for visual problem-solving operates on many levels at once. Forces, structures, relevancies, and implications are discovered by obscure and devious routes, paths and methods of thinking that are incapable of being taught intellectually, and are, incidentally, being increasingly employed in scientific and social research.

In this iconic age, when trendy popularity often reigns as the measure of merit, and banality can pass for wisdom, all students need to have the synthetical and interactive tools of visual literacy that enable them to evaluate and take responsibility for the visual statements they support and make. They (and we) can thus rediscover the richness of the world with an educated and civilized vision, with sensitivity to the visual statements of others and to the ecology of which we are all a part.

Context for the Figures

Except for a brief period when figures virtually filled the entire format of my paintings, context has been a secondary visual exploration. Abstract patterns and designs, surreal juxtapositions of conflicting spaces, landscapes both semi-realistic and imaginary—what I call "magiscapes"— interior spaces and still-lifes, and nebulous, stained color fields, have all been explored and utilized.

A recurring theme since my earliest abstract landscapes is the confrontation of earth, water, and air. It's a context so basic to our life on this planet that it is free of artifice and dissemblance; and represents foundational truths that I hope to discover and depict with the nude as well. Air, earth and water, together with fire, are known as "The Elements" that constitute the material universe. That fire is included I find fascinating, for it operates on levels of experience quite different and distinct from the concreteness of land, sea, and sky, and has therefore, not been an issue of direct concern in my work. But as a metaphor for energy, the life-force that suffuses all, that is made manifest by human use from Vulcan to the technologies of today, it may be present after all. The fire in my belly that keeps me painting. The nudes as Fire. I like that.

Line

For several years I drew directly from the model onto primed canvas, and then painted out all but the exterior edges to investigate figure-ground relationships. As my drawing became more confident, it became excruciating to continue to paint out the interior contours. When lines first entered the paintings, they were painted of equal width, creating a tension between the surface of the painting and the volume of the figure. A few years later canvas was left exposed to be the outlines of the figures, as well as negative spaces and sometimes positive forms. And then I limned figures and some botanical forms in metallic leaf paints, and a paint thickened with modeling paste and applied with a pastry tube. Line, "the most musical element, carrying us on in time," according to Kenneth Clark (*The Nude*, New York: Pantheon, 1956, p. 102). The accuracy of the line, that it captures the subtleties of the form so sensitively that all the stresses and directions, weight and depth, are expressed by it, is a challenge of unending fascination. Together with subtle exaggeration of foreshortening to enhance the illusion of depth, the eye of the beholder—through knowledge of the human figure—interpolates volume into the drawn lines. Getting a simple line to express so much is a skill and vision in which I take much delight, and find no small amount of amazement.

Light

My resistance to depicting light and shadow, chiaroscuro, was a deliberate decision, and had several reasons behind it. One was the tedium to concentrate on it when drawing. It nails one down to replicate what one sees, and with multiple light sources, the process becomes complex. While I was capable of such replication, I found it confining and tiresome. Another reason I left out shadows was in homage to Oriental art that had provided me so much inspiration. In Oriental art, shadows are not depicted because they are unreal, have no corporeality. I don't subscribe to this as a belief, but found it charming, pleasant, simplifying and, for a time, I amicably embraced it. But just as I reached a point when I could no longer ignore the interior contours, and had to give line its full glory of expression, there came a time when I could no longer ignore the magic of light and shadow. I was fascinated, when drawing the figure, with how shadows do as much to conceal form as to reveal it. Shadows contain mystery and expressiveness, and are a wonderful and potent metaphor for our shadow-sides and shadow-selves. As I continued to draw from the figure, the desire to incorporate chiaroscuro in my drawings became undeniably powerful. I practiced drawing oversized flowers with exaggerated tonalities, and copying master drawings, toward becoming both visually and technically more proficient. Line, as I had been using it, had to relinquish some of its power, a loss I mourned, and tolerated only when I found an equally powerful way to use light and shadow.

The breakthrough painting, AKEN, is a self-portrait in which I seem to be emerging from the morass that my search for adequate shading expression had plunged me. I was also emerging from a deep depression that followed the loss of a significant love relationship, and the completion of a major thematic exhibit of my work with a model who has no hair. (I am currently writing a book—from which parts of this narrative are excerpted—about the exhibit and the development of my work with this model.) The new group of chiaroscuro figures emerging from fields of color began as the TAKEN AND DISCARDED paintings, but became the TAKEN AND TREASURED series as I learned to love again.

The Synapse Paintings

SYNAPSE is a 1978 painting of the bald model that contained imagery inspired by some electron microscopic photographs of nerve cells that I had seen. In 1984 I came to know the person who bought the painting, and thus had an opportunity to become reacquainted with it. As I gazed at it I discovered a universe begging for further exploration: an abstract imagery inspired by the neurons, axons, dendrites, and synapses in the cerebral cortex and central nervous system. Thus was born the SYNAPSE series, created in 1986, in which one canvas is inserted into a larger canvas. The pieces cut out of the large canvas of the SYNAPSE paintings to accommodate the inserted painting, inspired the SYNAPSE RECIPROCAL series. The canvas fragment is inverted and collaged to an enlarged figure from the small SYNAPSE canvas figure drawings. The drawings of hands that I made for the SYNAPSE paintings inspired the Synapse HAND series that contains an impasto neuron imagery that remains to be developed further. There are seven of these color-saturated bridge-building trios (SYNAPSE, RECIPROCAL, HAND) on cotton canvas that were created from 1985 to 1986.

AKEN, a self portrait from the TAKEN AND TREASURED paintings, similarly catalyzed the DENDRITE series. After working several years on cotton duck canvas, because of the whiteness and luminosity it gives to colors, I longed to return to linen, a fiber with which I am most simpatico. Its color, its feel, its smell, and that it continues to live forever perpetually nourishing itself from air and moisture, make it an ideal ground support. As such, it is a metaphor for something I wish to achieve in my paintings: a quality that goes far beyond an objective presence, that continues to nourish by revealing levels of interpretation and meaning only over time.

Working with a dancer friend I have known for many years, I wished to get some action into our poses, ~~and so turned~~ to the camera to capture gestures no model could hold, and then refine the drawings in later sessions. The gestures, together with my growing boredom with the confines of a four-square rectangular format, impelled a breakout. But to where? Artists today are faced with an expansion of visual media, an absence of restrictive styles or schools, and thus confront an infinitude of possibilities. How to make any decision can be stymieing. Such junctures call for that witches' brew of intuition, personal proclivities and resonance. I was led to a small change in format, to the trapezial shape (four-sides with each side a different length unlike the trapezoid that has one pair of equal opposite sides). A rectangular canvas bolted to one side of these shaped DENDRITE paintings contains an enlarged area from the figure on the trapezial canvas. This taking out and tacking on is, in a way, the opposite of the SYNAPSE series where something was cut out and replaced by another image.

Where there are dendrites, there are axons, and the AXON series is of a male model on a trapezial linen canvas into which a rectangular cotton canvas with abstract axonic imagery has been inset into one side. Lacking a male model at the time of making these paintings, these figures of a non-dancer drawn some years ago, lack, I feel, the expressiveness and immediacy of the DENDRITE series.

Welcoming the Conceptual

Increasingly, perhaps influenced by my research and thinking about visual literacy, I have been seduced by theoretical and abstract ideas. Thus in recent works, several series of paintings have been inspired by words and concepts, and the neuronic imagery has been given solo voice. For example, synoicous is a botanical term in which a plant contains both female and male parts. With five underway, but only two from this series of nine completed so far, the SYNOICOUS paintings are comprised of two-canvases: one each linen and cotton, trapezial and rectangular, and male and female. The theme of the interaction of man and woman has occurred in my work for twenty years, and I have longed to find representation of a sincere union. I was initially shocked by the appearance of these paintings as they evolved, and discarded two months of work on my first attempt at one of the paintings, USSY, because it was lost in confusion. Reluctantly I acknowledge that these paintings express unbreachable barriers and yawning chasms that seem to persist between men and women even when we try to come together intimately. I wonder what is in the way of expressing that desired union?

In a lighter vein, SYNECDOCHE is a figure of speech in which a part stands for the whole. These ten paintings are small, ranging in size from five to twenty-four inches, and were reclaimed from the holes cut for inserted canvases, and salvageable fragments from otherwise failed paintings. Once stretched, I kicked these found works around my studio floor, and discovered that they fit together into, like my own, a crooked smile.

Evolution

As my work has evolved from abstract landscapes through geometric abstractions; to figure-ground-pattern explorations, and on to linear figures with inner and outer realities; to working with the ultimate nude: a woman with no hair; through loss and discovery, color and value; the one thing the paintings have in common besides their creator is that they bring messages from my unconscious, little of which is articulable. More than anything else, I paint so to come to know what I otherwise could not know. The paintings both record my development as an artist and as a person, and tell me about that development, which I posit is basic and central for all of us. From the paintings I learn, sometimes immediately, but often after a period of time, who and what I am, where I am relative to past experience. They are such a spur to memory in that I can smell and taste and feel the atmosphere, climate, and inner urges of my life at the time of their creation; evoke and collapse a passage in time and space. Often the paintings contain paths or directions in which to take my next, or some future, step. When I follow those directions with total submission, then, somehow, my entire life takes on an integrity and a momentum: all the trials and tribulations of daily life seem minor in relation to what I'm exploring and discovering. I am still aware of realities and atrocities in the world, but also feel that my potential for making a difference is to follow this path. I hope that my paintings are a visually literate affirmation of life and its potential for excellence, integrity, beauty, and enrichment.

© Adapted from a slide presentation at the International Visual Literacy Association Meetings, Virginia Tech, Blacksburg, VA, October 22, 1988.

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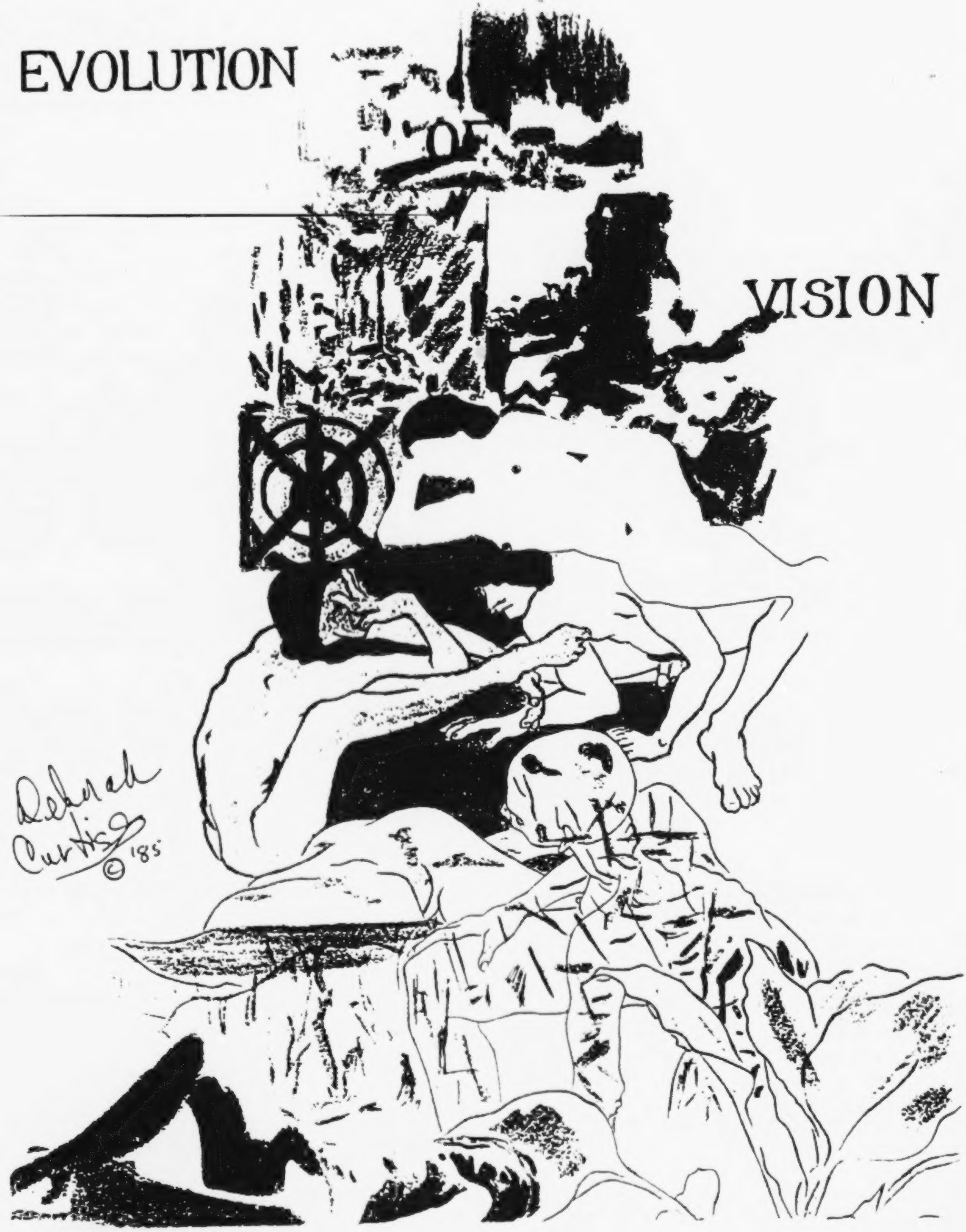
EVOLUTION OF VISION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Using the Mask as a Vehicle of Communication

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The purpose of this paper is to explain a studio project included in the Visual Communications course which I teach to non-art majors, specifically communications majors with areas of concentration in Public Relations, Broadcasting, and Advertising. This lecture and studio course addresses the interrelationship of fine art and mass media, and explores the influence of both on society. Art and mass media are means of communication which use iconographic imagery to reflect and reinforce the beliefs and values of the culture, and to serve as a cohesive agent for the community.

One of the studio projects included in the course work is "Using the Mask as a Vehicle of Communication." The mask is an ancient means of communication indigenous to most cultures. According to Napier, 1986, it is "The most widespread form of disguise,. . . not only illusory and make-believe, but also pardoxical. A paradox is something that appears self-contradictory, infringing upon the law of contradiction. Is it what it appears to be or is it something else?" (pp. 1-2). Masking is a ritual transformation of the human actor into another being. The mask is a powerful image used in performances which unify the community. Through experiencing the cultural myth in visual form, the viewer remembers the message and is more easily influenced than with verbal narration alone. In non-technological societies, masks are important elements in magic rituals performed to keep man in accordance with nature. Spiritual leaders use masks to maintain social-political, military, and religious power. A mask can allow its wearer to become a different being through "mystical participation" in ceremonial rituals.

As a theatrical role playing device, the mask can allow the wearer to assume different and multi-characters. Masks are also functional in theater by providing voice applifiers such as built in megaphones. Also, the facial image can be stylized to clarify and emphasize which emotion or expression is portrayed by a particular character's personality.

The studio project is preceded by a research assignment to gather information and write a short formal paper on the use of the mask. The students are asked to choose a concentrated research topic such as a particular culture which uses masks or a particular occasion when masks are worn. Other supporting topics might be the psychological impact of masking, Carl Jung's theory of the "Persona", death masks, tatooing, etc. On the day the papers are submitted, the class period is spent with the students sharing the information from each topic researched. As each student gives a brief synopsis of his or her paper, I write on the chalkboard categorizing the information, according to the intention of the mask, i.e. ceremonial, theatrical, and festive. These three categories are not mutually exclusive. There may be some overlapping, i.e. Halloween began as a religious ritual and has evolved into a festive occasion. The information could be listed as below:

Ceremonial: To contact and celebrate the spiritual world for therapeutic purposes and exorcisms; to insure good harvests, successful hunts, successful military conquests; to honor family lineage through ancestoral worship; to maintain the power with the shaman; to practice animism and mystical participation manifesting animal (theriomorphic) and human (anthropomorphic) imagery in their masks.

Theatrical: To reinforce the myths of polytheism; to portray archetypical characters such as the hero, the king, the wise old man, the trickster, the maiden, etc.; to juxtapose opposites; used in such cultures as Japanese, Chinese, Korean, ancient Greek, etc.

Festive: Used to conceal the wearer's identity on such occasions as Carnival, Mardi Gras, Halloween, Beaux Arts Balls, etc.; the origin and purpose of masking on such occasions.

Other Topics: Psychological reasons for wearing a mask, death masks, tattooing, veils, mythological imagery, transformation, etc.

The studio assignment is for each student to make a mask which is a unique statement, a product of the student's imagination. The mask may also have historical or traditional references. It is not necessary that the mask reflects the culture which was researched in the student's paper, but the research paper and the sharing of information suggest various possibilities of development. The message or statement might refer to an issue addressed in the course study such as understanding man's role with nature and with technology, archetypical imagery, mass media imagery, celebrity status, mythology, duality, etc. The content might be social-political, didactic, narrative, or autobiographical. The purpose of this project is to encourage creative thinking and for the student to "realize" his idea by constructing a visual product. The students in this course are majoring in advertising, public relations, and broadcasting. In their vocations they will not be making art but will be generating ideas and concepts.

A benefit in using the mask motif as the basis of a studio project is that the familiar format of a "face" reassures the non-art major and alleviates the intimidation of the "blank page" which can cause a creative block in beginning a visual project.

On the day the completed masks are submitted for grading, each student presents his/her mask artwork for a group critique. The artwork is explained by (1) Content: the meaning, the message, or the mood evoked, and (2) Form: the media, the visual elements, and the principles of organization.

Content:

In every critique, the past, the present and the future are represented. Reference to traditional mask usage gives a student a sense of the past and provides empathy for our primordial ancestors and for members of present non-technological societies who continue to live close to nature. The present is portrayed by modern issues or autobiographical references. Since this course was designed for communications students, mass media (television, films and celebrities) is often an inspiration. A broadcasting student who recently interned as a disc jockey made a mask from old 78 and 45 records, heating the records and bending them into facial planes. Social and political issues are addressed satirically and didactically. These issues have included drug usage, materialism, racial prejudice, governmental policies, sexual relationships, current events. In creating an autobiographical mask, the student becomes reflective of his personality and values. Duality and the multi-faceted psyche have inspired moveable masks. One was constructed like an altarpiece triptych which opened and closed to reveal the "false face" and the "true face". Reversible faces show opposing emotions. The future is suggested by man's interaction with technology. The message is sometimes positive, as in man becoming autonomous through technology. Often the message is an apocalyptic warning, revealing the student's concern for the future in that we live in a time when global destruction is a possibility. The message of the passage of time has been shown using a clock face motif as a pun on the face of the mask. The message or content is 50% of the project's grade.

Form:

The form (the compositional design, the choice of materials, and craftsmanship) is the remaining 50% of the studio grade. The construction of the mask can take two avenues: (1) an impression of the student's own face using orthopedic plaster bandages, or (2) a three dimensional design constructed from planes cut from foam board. Three dimensional features of the face (eye sockets, eyebrows, nose, ears, horns, mouth, etc.) can be formed from styrofoam cups cut into concave and convex shapes. The suface may be painted or collaged. Color choice, mixing, and application are important considerations. In previous lectures, the students have been introduced to color theory and the psycological impact of color on the viewer. Embellishments and surface additions should reinforce the message. A traditional mask referring to an agrarian ritual might include natural materials, i.e., twigs, grain and grasses, dried beans, seed pods, nut shells, etc. Found objects and found images from mass media can refer to memorabilia or to Dada Art emphasizing remnants of our society. Discarded objects are revitalized into art statements. One student used discarded electronic equipment from a television/radio repair business to enhance her cyborg mask "tuned in" to mass media. Hardware stores are sources for hi-tech, futuristic materials, i.e plastic tubing, reflective mylar, metal screen, metallic spray paint, nuts, and bolts, etc.

Knowledge of the visual elements and an understanding of visual literacy is important in choosing the appropriate tool and form to express the visual message. I believe this project provides valuable experiences in imagining new ideas; reflecting on history , society, and oneself; and making aesthetic evaluations. It also provides an opportunity to work in a wide range of media, traditional and non-traditional.

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Enhancing Visualized Instruction: A Research Overview

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Introduction

The primary role of instruction is to enhance information acquisition. The most efficient way to transmit information is by means of the spoken word; however, experience has shown us that the spoken word is not the most effective mode of communication. Since we live in a highly "visualized" society, the use of visual media to complement oral/verbal instruction has become a ubiquitous means of transmitting information. Educators at all levels are increasing their use of visual media in instruction and training to improve the quality of teaching and learning. Although the primary use of visualization in the instructional process is to facilitate learning, it appears that its presence is being improperly perceived as the solution to a wide variety of different type of instructional problems.

At present, educators have no way of knowing whether one type of visual is more effective than another in transmitting certain types of information, nor do they know whether instruction without visuals would be any more effective than the same instruction with visuals. The importance of this problem is brought into focus when one becomes aware of the tremendous volume of visual materials being produced both privately and commercially. Obviously, this indiscriminate proliferation of visual materials is not in itself a guarantee that educational needs will be satisfied.

The Basic Problem

The basic problem in using visuals is that visual illustrations often are not produced primarily for their instructional value. Little concern is given during the production stage to the role of the visual in complementing the oral/printed instruction or to the influence the visual has on the learners' cognitive structures. Much of the available research on visualization offers little guidance in the instructional environment since it does not deal with sustained cognitive learning of the type valued in the schools. Additionally, most of the studies evaluating the effects of visualized instruction use instructional materials which possess little or no instructional consistency or instructional congruency.

The Basic Need

In order for valid assessments to be made of the contributions of visualization to the instructional process the treatment materials need to be designed specifically. The instructional content must be structured logically and have content validity so that the general objectives may be achieved. Enabling objectives need to be identified and appropriate test items developed. The instructional content used in the Program of Systematic Evaluation (Dwyer, 1972, 1978, 1987) focused on the human heart, its parts, locations, and functions during the systolic and dystolic phases. The content was selected because it permitted the evaluation of several learning objectives. The script was then analyzed (pilot-tested) to identify those areas in the instruction where critical information was being presented--areas where it might reasonably be expected that students would experience difficulty in comprehending the intended information. Thirty-seven such areas were identified. Visuals were designed specifically to illustrate the information presented in each of the identified critical areas.

General Research Conclusions

In general, the research conducted in the Program of Systematic Evaluation has indicated that effectiveness and efficiency in visualized instruction are primarily dependent upon a) the amount of realistic detail contained in the visualization, b) the method by which the visualized instruction is presented to learners (externally paced vs. self-paced), c) learner characteristics, e.g., intelligence, prior knowledge in the content area, reading and/or oral comprehension level, d) the type of educational objectives to be achieved by the learners, e) the technique(s) used to focus learner attention on the essential instructional characteristics in the visualized materials, e.g., cues such as questions, arrows, motion, verbal/visual feedback, overt/covert responses, and f) the type of test format employed to assess learner information acquisition, e.g., visual tests and verbal tests.

Following is a sampling of the general and specific conclusions obtained in the five independent variable categories in the Program of Systematic Evaluation.

A. Degree of Realism

- Visualization containing too little or too much realistic detail may lead to negative motivation on the part of the student. Effective visualization contains sufficient information to encourage active student participation without interfering with his/her attending to the stimuli.

- The array of different types of available visualization represents increasingly differentiated degrees of realistic detail (line drawings to realistic photographs). Excessive realism in a visual may impede rather than facilitate optimum student achievement; the visual may contain so much stimuli that the students are unable to focus their perceptual energies long enough or clearly enough to engage in the kind of interaction necessary for the desired kinds of learning to occur. Consequently, a photograph of an object or situation may present a "perfect" image of reality but may fail to clearly illustrate that part of the message to be communicated.

- Different types of visuals (containing varying amounts of realistic detail can provide the learner with the same information without providing the same amount of stimulation. Consequently, two different types of visuals may have the same instructional potential for facilitating student achievement. Operationally, differences in the amount of realistic detail contained in visuals has to make a difference to be a difference. Visuals that are functionally indistinguishable in terms of improving student achievement are functionally identical.

- The process of simplifying or editing realistic detail from visuals may reduce or eliminate important characteristics prerequisite for learning to occur, e.g., the ability to distinguish between relevant and irrelevant aspects of an object or situation. An edited visual may provide a too narrow perspective of reality in which the student is less able to recognize necessary patterns essential in making meaningful interpretations of the visual stimuli. Editing or simplifying realistic detail beyond a certain point does not lead to uniformity of perception.

- The relationship between the amount of realistic detail in visuals and student achievement is curvilinear rather than linear. There are points beyond which increases in the amount of visual stimuli in visuals impede rather than facilitate learning. For this reason the amount of stimuli in visuals should probably be thought of in optimal rather than maximal terms. There is an optimal level beyond which adding additional realistic detail produces no further increases in learning.

- The advantages and disadvantages inherent in different types of visuals need to be identified and isolated functionally in relation to their relative contributions in facilitating specific kinds of learning. Only when this has been achieved will we be permitted to effectively manipulate and integrate the different types of visual materials to ensure that the ones being used are the ones which will produce optimum learning.

B. Method of Presentation

- There is a relationship between how visualization is presented to students and the amount of student learning that will occur. The types of visuals most efficient and suitable for the rapid transmission of information (externally-paced instruction) are not the ones most effective in facilitating optimum amounts of information when the information is being received in a self-paced instructional format.

- When complex visuals are used in the instructional process, the student needs adequate time to make the proper perceptual discriminations.

C. Level of Educational Objective

- No single type of visual can be identified as being most effective in facilitating student achievement of all kinds of learning objectives. Many of the conditions of learning are specific to a particular medium, a specific type of educational objective, a particular type of student, etc.
- There are some types of learning tasks for which learning cannot be enhanced by the use of visuals.
- Certain types of visuals seem more appropriate than others in facilitating student learning of specific educational objectives.

D. Individual Differences

- Specific individual difference variables are important instructional variables (age, I.Q., prior experience, reading comprehension) which determine the effectiveness of different types of visualization. For example, learners being exposed to a new content area would profit optimally from line drawings, whereas individuals more familiar with the content area would profit from the more realistic types of illustrations.
- Some types of visuals are effective over a wide range of audiences, methods of utilization, and types of educational tasks.

E. Cueing Techniques

- There is substantial evidence which attests to the fact that the judicious use of color in visuals is a viable instructional variable in improving student achievement of specific educational objectives.
- The instructional effectiveness of a specific type of visual is related to the number of relevant cues present; either too many or too few cues affect learning adversely.
- Varied methods of cueing visualized instruction can be used to heighten student interest and enthusiasm; however, constant repetition of a single type of cueing technique may quickly produce disinterest and boredom.

- The inappropriate use of visual materials or gimmicks in the teaching-learning process may actually direct learner attention away from essential learning cues and depress subsequent achievement.
- All attention gaining cueing strategies are not equally effective in increasing student achievement.
- Cues can be effectively employed to facilitate student achievement of specific educational objectives.
- When visualized instruction has been properly designed and employed, visual testing provides a more reliable and valid assessment of the students' levels of content acquisition.

Specific Conclusions

A. The use of visuals specifically designed to complement oral and printed instruction does not automatically improve student achievement. For example, when visualization is used to illustrate basic terminology for which students already possess meaningful examples, then the use of visualization is superfluous. Similarly, when visualization is used to complement already complicated material, very little additional learning is achieved. In general, a major portion of a student's learning results from either oral or printed instruction since both are sequentially organized and presented. Often when visualization accompanies complicated instructional content, students have a tendency to scan all of the visualization immediately. Many students are not adept in switching back and forth from the oral/print to the visual channel as the crucial cues are described and/or presented in the respective channels; a certain amount of frustration occurs causing the student to block out inputs from the less familiar communication channel (the visual) and concentrate more intently on the more familiar (the oral or print).

B. The type of visual illustrations most effective in transmitting information is dependent upon the type of information to be transmitted. For specific types of educational objectives where visualization has been found to improve student achievement, simple line drawings seem to be the most effective type of visualization. In general, the least effective type of visualization is the more highly realistic illustration. Apparently, the additional stimuli contained in the realistic drawings and photographs may, by distracting students' attention, interfere with the information being transmitted. It seems that realistic illustrations and photographs can be aesthetically pleasing and very effective in acquainting a learner with reality but are limited in value for instructional purposes unless the learners are somewhat familiar with the material being presented or are experienced in learning from visual materials.

C. Identical types of visual illustrations are not equally effective when used for externally paced and self-paced instruction. The effectiveness of a particular type of visual in promoting student learning depends on the amount of time students are permitted to interact with the visualized instruction. In general, for students receiving externally-paced instruction, the simple line drawings have been found to be most effective; for students receiving self-paced instruction, the more realistic detailed, shaded drawings are most effective.

Students participating in externally paced instruction view their respective instruction for equal amounts of time. The process of identification and discrimination is time consuming; the more intricate the visual stimuli, the longer it takes for the student to identify and absorb the information. The more realistic illustrations contain more information than the less realistic, but the students apparently do not have sufficient time to take full advantage of the additional information provided. It appears that realistic illustrations containing excesses of information are not useful when students are not given adequate time to scan and interact with the information.

The effectiveness of the more realistic presentations in self-paced instruction may be explained by the fact that students are permitted to spend as much time as they wish in absorbing as much information as necessary to complete their understanding. The less realistic illustrations possess less detail and are, therefore, limited in the amount of information they can transmit, regardless of how long the students are permitted to study them.

D. For students in different grade levels, the same visuals are not always equally effective. A student's ability to profit from visualized instruction is related to his intelligence, reading comprehension level, and background knowledge in the content area being presented. This does not mean, however, that special or different types of visualized materials have to be used for each grade level. Fortunately, identical types of visualized materials often are effective for specific educational objectives across several grade levels.

E. For specific students and for specific educational objectives, the use of color in certain types of visuals appears to improve student achievement. For other educational objectives, however, the effectiveness may not be enough to justify the added cost of color. Often the realistic detail in the visuals is accentuated by color; thus, the students are better able to make the appropriate distinctions to obtain the necessary information. Color may make the visuals more attractive to students, who may pay closer attention as a result of its use.

F. Student perceptions of the value of different types of visual illustrations are not valid assessments of instructional effectiveness; that is, aesthetically pleasing visuals may not be of great instructional value.

G. The realism continuum for visual illustrations is not always an effective predictor of learning. An increase in the amount of realistic detail contained in an illustration will not necessarily produce a corresponding increase in the amount of information assimilated.

H. Boys and girls in the same grade level (high school) learn equally well from identical types of visual illustrations when they are used to complement oral instruction.

I. Identical visual illustrations are not equally effective in facilitating the achievement of students possessing different levels of entering behavior (prior knowledge in a content area).

J. Merely increasing the size of instructional illustrations by projecting them on larger viewing areas does not automatically improve their effectiveness.

Results from studies conducted in the Program of Systematic Evaluation are making significant contributions to the development of a comprehensive understanding of the instructional potential inherent in different types of visualization. However, because there are so many variables associated with the learning process and because most of these variables are continuous rather than discrete in nature, it is doubtful whether the development of a single learning theory which will function as an effective predictor of visual learning will ever be possible. Essentially, the research indicates that if quality visualized instruction is to become a reality, product development has to reflect considerations which take into account method of presentation, student characteristics, type of learning objectives to be achieved, cueing techniques employed, and testing format.

Discussion

Introduction

It is becoming extremely clear that quality visualized instruction implies specificity of purpose; quality instruction cannot be randomly designed for random groups of learners. However, it can be effectively designed and produced so that it can be efficiently utilized by broad bands of learners possessing similar learner-related characteristics. Therefore, it is the process of instructional design that is prescriptive. Instructional design should effectively manipulate the instructional environment so that the learners will attain predetermined levels of achievement of specific types of educational objectives. To achieve this objective there are three major categories of independent variables that can be considered and/or manipulated--the stimuli, the organism, and the organism's response. In addition, textbooks on educational psychology often contain lists of laws and principles of learning. Some of the more basic of these laws are 1) law of effect, 2) the law of exercise, 3) the law of readiness, and 4) the law of association. In addition to these basic laws, there are several principles which can be used as guidelines in developing effective instructional environments: 1) learning is a self-activity, 2) we learn at different rates, 3) learning is a continuing and evolutionary process, 4) learning results from stimulation to the senses, 5) positive reinforcement enhances learning, 6) we learn best by doing, and 7) the "whole-part-whole" learning is most effective for enhancing learning. Our research in the Program of Systematic Evaluation over the past twenty years has shown that the appropriate use of visualization to complement print/oral instruction is a viable instructional variable in facilitating increased student achievement of specific educational objectives. A number of conditions have to exist for this statement to be valid. There has to be both instructional consistency within the instructural unit (e.g., natural progression among the facts, concepts, rules, problems to be learned) and instructional congruency between the objectives and the test items. If these conditions exist and student performance on criterion tests is less than desirable, item analyses then should be utilized to direct attention to points in the instruction where modification (redundant visualization) may be integrated. Under these conditions, specifically designed visualization will enhance learner information acquisition.

Visual Rehearsal

Visualization, although extensively used to improve learning under a wide variety of circumstances is, in itself, only a "mild" rehearsal strategy and, when used alone usually will not optimize student learning. A number of observations may be offered to elaborate on this statement. Students do not always look at visualization with the same intensity for equal amounts of time or with the purpose of learning from them. Many students look at visualization to familiarize themselves with "reality" and not to identify and/or integrate critical learning cues so as to be able to better comprehend the instruction. This being the case, additional structure within the instructional unit or within the visualization itself has been found to be successful in "coercing" student attention and maximizing student achievement. For example. advance organizers, embedded questions, verbal/visual feedback, color coding, arrows, covert/overt practice, etc., used to complement visualized instruction have all been found to improve student achievement of specific educational objectives--where previously deficiencies have been identified.

The law of readiness is probably the most significant to the instructional designer. As long as one is considering the learning of a single individual, it is not necessary to consider the procedures inherent in instructional design. However, as soon as two or more learners are taught in a single group (or with the same materials via independent study) the problem of differences between them assumes considerable importance.

This problem is magnified because these are great variations in progress in learning in any individual. Differences among learners leads one to think in terms of different instructional treatments (ATI); however, the notion of developing different parallel treatments has not been fruitful--primarily because it costs money, not because it would be ineffective. The terms efficiency and effectiveness which permeate the education literature are convenient terms to express two sides of cost-benefit analysis: cost and benefits. It is unrealistic to look only at costs or only at benefits. In designing instruction it is vital to compare costs against benefits and, in this way, develop a true picture of costs. Consequently, utility should be the focus of every properly designed instructional system. Utility as an outcome is an important concept in instructural design when it is understood that what is being manipulated in an instructural environment is the various categories of independent variables and for every independent variable that exists on a continuum there is an excess, a deficiency, and a mean. For example, it has been found that the relationship that exists between learning and media utilization is not linear but curvelinear--beyond a certain point the addition of additional stimuli impedes rather than facilitates learning.

Learning Strategies

In general, learners "high" in prior knowledge (of the content material), reading comprehension, and I.Q. possess similar strategies that enable them to profit from instruction rich in information, concepts, and sensory images. These strategies become mediators through which the learners are able to initiate the necessary operations of abstracting, organizing, hypothesizing, relating, and synthesizing necessary to interact with and profit from the instruction. It is for this reason that good students always do best even though they may receive poorly-organized instruction. They have the ability to initiate and impose their own organization and structure on the content and make sense out of the instruction. Learners identified as low and medium in prior knowledge of the content, reading comprehension, and I.Q. can be considered deficient in terms of possessing the appropriate mental processing strategies. Consequently, instructional design strategies that replace, improve, and/or provide a covert mental activity which learners would have to activate on their own generally function to improve information acquisition.

Following is a sampling of some of the design variables which may be systematically juxtaposed throughout an instructural sequence to reduce learner's dependence on self-initiated mental interaction strategies.

Organizational Outlines
- Subheadings
- Enumeration of points (e.g., first, second...)
- Logical ordering and sequencing of content

Preparatory/Motivational Procedures
- Advance organizers
- Verbal/pictorial overviews (summaries)
- Verbal directions--attend to/notice this
- Embedded questions

Attention/Directing
- Visual pointers/pop-in labels, arrows, circling
- Italicizing of printer material
- Use of color for emphasis
- Progressive build-up or disclosure
- Disassembly or reassembly (implosion) of pictorial elements
- Close-ups, large pictures, large type
- Movement and change
- Emphatic repetition of elements to be perceived

Eliciting Active Participation

- Overt speaking out
- Written responses
- Built-in requests for responses in pictorial/printed instruction
- Notetaking
- Question insertion
- Covert thinking responses

Feedback

- Right/wrong
- Scenes in visual format to confirm verbal response
- Progressive problem development

Care has to be exercised so that not too many design characteristics are integrated into a single module since one design technique may override the effects of another. However, it is also possible that different design techniques may exert cumulative positive effects when they function in combination with other techniques. To say that the embedded design characteristics will only assist the low and medium groups is not completely accurate. Learners in the high groups are intelligent enough and take every opportunity to take advantage of embedded design strategies. This observation is supported by the fact that even though all learners (high, medium, low) may achieve a predetermined level of competency, the learners identified as high will do so in significantly less time.

Schema Theory

Proponents of cognitive psychology indicate that a person's schemata is an important determinant in how and to what degree he/she will learn declarative and procedural knowledge. The degree to which the learner possesses the right associations and/or has an efficient learning strategy with which productive interface occurs with the content to be learned determines the time necessary for learning to occur. Essentially learning consists of making associations and chaining these associations into concepts, rules, and problem-solving strategies. The rate at which learners are expected to make associations and the type of chains they are expected to develop (some chaining requirements are very complex and elaborate) influence the time and amount and type of practice needed by the learners to achieve predetermined objectives.

The extent that learners are deficient in the basic associations of the content to be learned and strategies for establishing viable chains linking the associations determines the amount of structure needed in an instructional sequence. In this respect, instructural design and development refers rather specifically to the ways the instructural message is manipulated in the design and production process to influence conscientiously and deliberately the learning from that material. In achieving this objective we employ varied types of strategies (advance organizers, visualizations, questions, visual/verbal feedback routines, practice activities, elaboration routines, sequencing, structuring, repetition, etc.) throughout the instruction to aid learners a) to identify the critical instructional content to be learned, b) to facilitate the degree of interaction (practice time) with its content in order to move the information from short-term memory into long-term memory and c) to provide the degree of overlearning that is necessary to ensure that the retrieval capability is present under minimum recall/application conditions.

References

References and research results contained in this paper are based on citations and completed research studies conducted in the Program of Systematic Evaluation and are contained in A Guide for Improving Visualized Instruction (1972), Strategies for Improving Visual Learning (1978), and Enhancing Visualized Instruction: Recommendations for Practitioners (1987) available from Learning Services, Box 784, State College, PA 16804. Collectively these texts contain more than 1600 references generated by more than 800 researchers representing a variety of related disciplines.

An Overview of the Program of Systematic Evaluation (PSE)

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Introduction

The primary justification for the use of visual materials in the instructional process is to facilitate student learning; i.e., to illustrate and to clarify difficult teaching points and to insure the accuracy and standardization of the information being communicated. Prior to the beginning of the Program of Systematic Evaluation, educators had no way of knowing whether one type of visual illustration was more effective than another in transmitting certain types of information, nor did they really know whether instruction without visuals would be any more effective than the same instruction with visuals. The prevalent feelings was that one type of visual was as good as another in facilitating student achievement of different educational objectives and that the mere incorporation of visualization into the instructional process was the hypothetical solution to a wide variety of different types of instructional problems.

REALISM IN VISUALS

An inspection of the different types of visual illustrations reveals that they possess recognizable structural characteristics; that is, line drawings, detailed shaded drawings, photographs of three dimensional models, cartoons, realistic photographs, and so forth. It seems reasonable to assume that for instructional purposes visual illustrations are not multi-purpose in character--some may be more effective than others in facilitating student achievement of different types of educational objectives. It may be for the promotion of specific educational objectives visual possessing realistic detail beyond a certain point, add very little or, actually, decrease student learning.

A review of research in the field of visual education located only a few studies that investigated the relative effectiveness of visual illustrations possessing different amounts of realistic detail used to complement oral or verbal instruction. However, a number of theoretical orientations were identified, specifically, the iconicity theory identified by Morris (1), the sign similarity orientation developed by Carpenter (2), and Dale's cone of experience (3). For convenience, the orientations cited are referred to

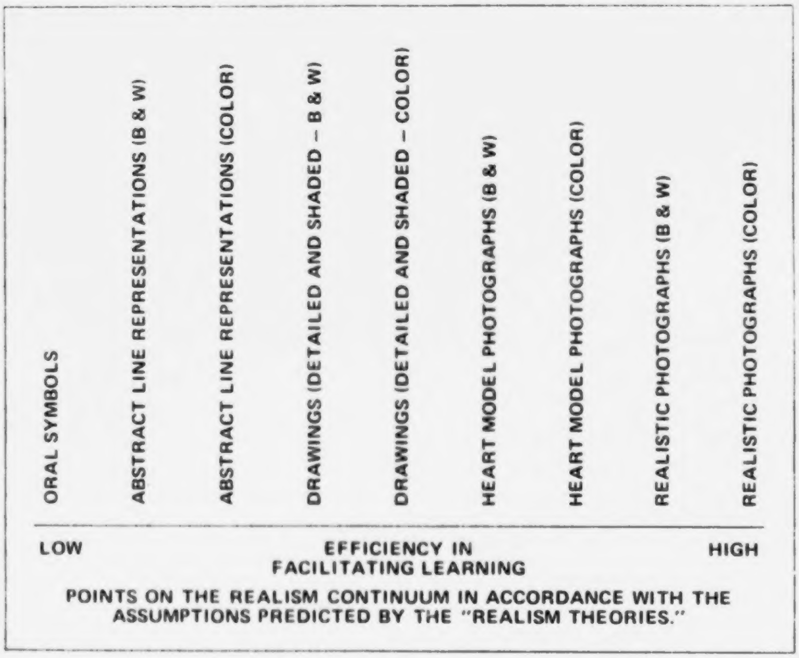
ORAL SYMBOLS
ABSTRACT LINE REPRESENTATIONS (B & W)
ABSTRACT LINE REPRESENTATIONS (COLOR)
DRAWINGS (DETAILED AND SHADED – B & W)
DRAWINGS (DETAILED AND SHADED – COLOR)
HEART MODEL PHOTOGRAPHS (B & W)
HEART MODEL PHOTOGRAPHS (COLOR)
REALISTIC PHOTOGRAPHS (B & W)
REALISTIC PHOTOGRAPHS (COLOR)
LOW
EFFICIENCY IN FACILITATING LEARNING
HIGH
POINTS ON THE REALISM CONTINUUM IN ACCORDANCE WITH THE ASSUMPTIONS PREDICTED BY THE "REALISM THEORIES."

Figure 1. Realism continuum for still visuals.

Related Research

There exist both theory and research which suggest that the basic assumptions underlying the realism theories--the bimodal presentation of information and/or the systematic procedure of increasing the amount of realistic detail in existing cues in a single channel presentation will increase learner acquisition of information--while plausible, do not adequately fit theoretical models proposed by other researchers. The fact that the perceptual system generally functions as a single channel system and that the central nervous system has a limited information processing capacity has been well documented (7-14). Miller et al. have indicated that it would be a mistake to assume that one cue added to another would increase learning by a linear increment (15). Their contention is that additional cues or excessively realistic cues may be distracting or possibly even evoke responses in opposition to the desired learning. Travers et al. say, "Merely confronting a person with stimuli identical to those emitted by the real environment is no guarantee that useful information will be retrained." (16, p. 119). Because excesses of realism in visuals may actually interfere with the effectiveness of visual materials, it is essential that we attempt to identify those characteristics within visuals that will facilitate student achievement of specific kinds of learning.

Initial Focus of PSE

The general focus of PSE was to identify the types of visual materials which would be most effective in facilitating student achievement of specific educational objectives when the content is presented by means of different instructional formats. Following is a list of specific questions which provided the initial direction for the PSE, (17, 37-39, 18, 9-10).

1. Are all types of visual materials (illustrations) equally effective in facilitating student achievement of all types of educational objectives?

2. Are identical types of visual illustrations equally effective in complementing both oral and printed instruction?

3. Is the realism continuum for visual illustrations an appropriate and reliable predictor of instructional effectiveness when it is used to complement oral and printed instruction, or are there points on the realism continuum at which further increases of realism in visual illustrations fail to produce significant differences in student achievement of specific educational objectives?

4. Will the use of visual illustrations that are specifically designed to complement oral and printed instruction automatically improve student achievement?

5. Is color in visuals an important instructional variable in facilitating student achievement of specific objectives?

6. Will the use of visuals to complement oral/print instruction affect delayed retention of the content material?

7. Are student perceptions of the value of different types of visual illustrations a valid assessment of the instructional effectiveness of the visuals?

8. Does the method in which visuals are presented to students, e.g., slides/audiotape, television, programmed instruction, etc., affect the ability of the visuals to facilitate achievement of different educational objectives?

9. Does the amount of time students are permitted to interact with visualized instruction affect their level of achievement of different educational objectives?

10. Are identical types of visual illustrations equally effective for all education levels, or do the different types of visual illustrations possess differing degrees of instructional effectiveness for students at different educational levels and for different educational objectives?

11. Are different cueing techniques (motion, inserted questions, knowledge of specific learning objectives, etc.) equally effective in complementing visualized instruction?

12. Can oral and printed questions be used to improve the instructional effectiveness of visualized instruction?

13. Do boys and girls in the same grade level (high school) learn equally well from the same types of visual illustrations on tests designed to measure achievement of different educational objectives?

14. Is there only one visual learning continuum representing instructional effectiveness of visuals for complementing both oral and printed instruction?

15. Can student achievement of different educational objectives be improved by increasing the size of the visual illustrations that are used to complement oral instruction?

16. How does a student's entering behavior (prior knowledge in a content area) influence ability to profit from visualized instruction?

17. What effect do specific individual difference variables (intelligence, reading comprehension, educational level, etc.) have on students' ability to profit from different types of visualization?

18. What kinds of visual illustrations--in what patterns, combinations, and sequences--provide the best stimulus conditions for maximum achievement of specific kinds of educational objectives?

19. How does the type of reinforcement (printed vs. visual) that students receive in progressing through an instructional module affect their level of achievement of different kinds of educational objectives?

20. What specific individual difference variables interact disordinally with different types of visual illustrations for specific educational objectives?

Preparation of Materials

In an attempt to investigate the cited questions, a 2,000-word instructional unit on the human heart was developed. The script described the heart, its parts and the internal processes which occur during the systolic and diastolic phases. The content was selected because it permitted the evaluation of several learning objectives. Criterion tests were designed and developed to measure the designated learning objectives. The instructional treatment was presented to students and criterion tests administered. Student performance on the criterion tests was then analyzed to identify those areas in the instruction where critical information was not being acquired by the students. Visuals were designed specifically to illustrate the information presented in each of the critical areas. Eight complete visual sequences were designed and reproduced as a 2X2 inch slides; four sequences were in color, and four were in black and white. Each instructional sequence contained thirty-nine slides.

Basic Experimental Visualized Treatments

The eight visualized sequences were considered to be the experimental treatments; the students receiving slides or illustrations on which appeared only printed symbols of the terms being discussed in the instructional presentation were considered to be the control group. The amount of realistic detail possessed by the visual illustrations varied for each of the visualized treatments; however, all treatment groups received identical instructional content. The intent or objective of using different types of illustrations was to determine the relative effectiveness of the four different types of black and white and colored illustrations in facilitating student achievement of different kinds of educational objectives.

Oral/print presentation Students receiving the oral/print presentation received no visuals of the heart but reviewed displays containing the names of the parts and/or processes of the heart as they were discussed in the instructional presentation.

Simple line drawing presentation (color) Students receiving this treatment viewed simple line illustrations in color to complement their instruction. The colors used in this treatment, blue line on a pink background, were selected solely to provide color contrast and were not designed in any way to provide additional learning cues for the students. The color used in the three additional colored treatments did not intentionally provide more information than did their complements, the black and white treatments. However, the use of color in some instances may have facilitated more rapid identification of specific parts and related systems of the heart.

Detailed, shaded drawing presentation (black and white) Students receiving this treatment viewed detailed, shaded drawings (black and white) to complement their instruction. These drawings were more complex than the simple line drawings, and they represented the heart and its related parts more realistically, rather than merely identifying and locating them as in the simple line drawing presentations.

Detailed, shaded drawing presentation (color) Students receiving the detailed, shaded drawing presentation (color) viewed illustrations similar to those in the previous group, except that they were colored.

Heart model presentation (black and white) Students receiving this treatment viewed photographs of a heart model (black and white) while the heart and its related parts were being described in the instruction.

Heart model presentation (color) Students receiving this treatment viewed colored photographs of a heart model.

Realistic photographic presentation (black and white) Students receiving this treatment viewed realistic photographs (black and white) of the heart.

Realistic photographic presentation color) Students in this treatment group received realistic photographs of the heart which were in color.

Criterion Measures

In order to determine what type of visuals were most effective in promoting student achievement of specific educational objectives, four individual criterion tests were developed. Students received the drawing test first, then the identification and terminology tests, the comprehension test being administered last. Scores achieved on the four individual criterion tests were combined into a composite seventy-eight item total criterion test score. The Kuder Richardson Formula 20 Reliability coefficient for the five criterion measures was computed for each study. An average reliability coefficient for each criterion test has been computed from a random sampling of the studies; they are: .83, terminology test; .81, identification test; .83 drawing test; .77, comprehension test; and .92 total criterion test.

Generalizability of Results

It should be noted that in this program of evaluation the type of learning measured by the different tests is the important aspect, rather than the heart content per se. The learning objectives have generalizability in that they may be appropriate in all content areas. For example, 1) the objectives measured by the drawing test could be applied to students in a geography class who are learning the location of the fifty states, or to students in a mechanics course learning the relative locations of the various parts of a carburetor; 2) tests similar to the identification test could be used in any course in which the student is required to know the various parts of objects (for example, in a physiology course to indicate the parts of the human body, or in a botany course to name the parts of different types of plants); 3) the objectives of the terminology test--to evaluate student knowledge of specific verbal symbols --is appropriate to any content area; and 4) tests similar to the comprehension test can be used in any subject area in which the objective is to measure the student's understanding of complex procedures and processes.

Evaluation Procedure

In each study students were randomly assigned to treatment groups, received a pretest, participated in their respective instructional treatments, and received four individual criterion tests. Two different pretests were used at different times throughout the series of studies. They were: 1) a physiology pretest, used to measure the student's prior knowledge in the specific content area; and 2) the Otis Quick-Scoring Mental Ability Test (Form Fm), which provided an IQ score.

Scores achieved on the pretest measures were analyzed, and when significant differences occurred among treatment groups, these scores were used as a covariate to partial out their effect. Analysis of variance and covariance (where significant differences occurred on the pretest measures) were used throughout the cited studies. When significant differences between groups were obtained via the analysis of variance or covariance techniques, Dunn's "C" Procedure (initial studies only) or Tukey's W-Procedure was employed to analyze differences between pairs of means.

Method of Presenting Visualized Instruction

Each instructional medium has unique characteristics which should be employed to achieve specific educational objectives. Essentially there are two basic strategies for presenting visualized materials for instructional purposes. The first may be characterized as being externally paced - a situation in which students as a group receive instruction via film, television, transparencies, etc. The determining characteristic of the externally paced strategy is that the content material is linearly programmed in that it is presented sequentially, and that it is usually difficult for the student to slow down the rate of information presentation, to ask questions, or to review the content material during or after the presentation. In this method of information presentation all students receive the same instruction for the same amount of time. The implied assumptions associated with the method of presentation is that all students: 1) receiving the presentation are at the same level of content sophistication, 2) view the same thing (in a visual) at the same time, and 3) learn at the same rate regardless of the complexity of the content material being presented.

The second instructional strategy is called self-paced and is defined as a learning situation in which each individual student controls the rate at which he proceeds through the instructional materials (e.g., textbooks, workbooks, computer-assisted instruction, individualized slide presentations, videotape cassettes, etc.). In receiving instruction in this format, students are able to interact with the oral/print instruction and also interact with their respective visuals for as long as they feel necessary in order to comprehend the information being presented.

Program of Systematic Evaluation - Phase I

The text A Guide for Improving Visualized Instruction (18) documents efforts to reduce many of the criticisms of media related research and includes the complete instructional script, the pretest, the four criterion measures, samples of the eight types of visualization, one complete visualized sequence utilizing simple line drawings, along with a model for empirical development. During Phase I, for example, specific types of educational objectives to be achieved were identified; a specific instructional unit which permitted meaningful learning to occur was developed; four individual criterion tests were constructed which measured student achievement of different types of educational objectives, eight complete visualized experimental treatments were assembled, each containing visualization possessing varying amounts of realistic detail; and a stable experimental procedure was identified. Following is a list of general conclusions derived from the research conducted in Phase 1 of the Program of Systematic Evaluation (1, pp. 89-90).

1. The use of visuals specifically designed to complement oral and printed instruction does not automatically improve student achievement. For certain types of educational objectives, oral and printed instruction without visualization is as effective as visually complemented instruction. For other types of educational objectives the use of visuals designed to complement a particular instructional method and to facilitate achievement of a specific educational objective will increase student achievement of that objective.

2. All types of visuals are not equally effective in facilitating student achievement of different educational objectives. The type of visual illustration most effective in transmitting information is dependent upon the type of information to be transmitted.

3. The method by which students receive their visualized instruction (television, slides, programmed instruction) determines the type of visual that will be most efficient in facilitating student achievement of specific educational objectives. Identical visual illustrations are not equally effective when used for externally paced and self-paced instruction.

4. The effectiveness of a particular type of visual in promoting student achievement of a specific educational objective depends on the amount of time students are permitted to interact with the visualized instruction.

5. For students in different grade levels, the same visuals are not equally effective in increasing achievement of identical educational objectives.

6. For specific students and for specific educational objectives, the use of color in certain types of visuals appears to be an important instructional variable in improving student achievement. For other educational objectives, however, the added cost of color may not be justified from the instructional effectiveness viewpoint.

7. In general, for high school students for whom slides are used to complement oral instruction, differential effects attributed to various visualized treatments on immediate retention tests disappear on delayed retention tests.

8. Student perceptions of the value of different types of visual illustrations are not valid assessments; that is, aesthetically pleasing visuals may be deceptive in their instruction value.

9. The realism continuum for visual illustrations is not an effective predictor of learning efficiency for all types of educational

objectives when the visualized instruction is presented via television, slides, programmed instruction, and textbook formats. An increase in the amount of realistic detail contained in an illustration will not produce a corresponding increase in the amount of information a student will assimilate from it.

10. The use of questions to focus student attention on the relevant visual learning cues in the more realistic illustrations used to complement externally paced and self-paced instruction is not an effective technique for improving the instructional potential of the illustrations.

11. Boys and girls in the same grade level (high school) learn equally well from identical types of visual illustrations when they are used to complement oral instruction.

12. Identical visual illustrations are not equally effective in facilitating the achievement of students possessing different levels of entering behavior (prior knowledge in a content area).

13. Merely increasing the size of instructional illustrations by projecting them on larger viewing areas does not automatically improve their effectiveness in facilitating student achievement.

Program of Systematic Evaluation - Phase 2

The text Strategies for Improving Visual Learning (18) summarizes the results of Phase 2 of the Program of Systematic Evaluation. To provide an integrated and comprehensive treatment of the variables associated with visualized instruction, the text cites more than 650 articles, research results, insights, and conclusions of more than 625 researchers representing numerous scientific disciplines. The text emphasizes the interrelatedness of variables (e.g., degree of realism, cueing techniques, level of educational objectives, individual differences, method of presentation, and testing format) associated with the effective use of visual materials. Trends are drawn from prior research relative to the effective design and use of visual media. In his respect, it presents the concept of visual instruction, not as an isolated phenomenon, but as an interrelated constituent process operating at varying levels of complexity--the elements of which acquire significance only in the context in which they are used.

The following list provides a sampling of the generalizations which were derived from the studies conducted between 1972 and 1978 (18, pp. 96-97).

1. The realism continuum for visual illustrations applied to externally paced instruction is not an effective predictor of learning efficiency for all types of educational objectives. An increase in the amount of realistic detail contained in an illustration will not produce a corresponding increase in the amount of information a student will acquire for it.

2. The use of specific types of visual illustrations to facilitate specific types of educational objectives significantly improves student achievement of externally paced instruction.

3. All types of visuals are not equally effective in facilitating student achievement of different educational objectives when instruction is externally paced. The type of visual illustration most effective in transmitting information is dependent upon the type of information to be transmitted.

4. The use of visuals specifically designed to complement oral instruction does not automatically improve student achievement. However, for certain types of educational objectives the use of visuals designed to complement a particular instructional method and to facilitate achievement of a specific objectives will increase student achievement of the objective.

5. For specific students and for specific educational objectives, the use of color in certain types of visuals presented via the slide/audiotape format appears to be an important instructional variable in improving student achievement. For other educational objectives, however, the added cost of color may not be justified from the instructional effectiveness standpoint.

6. For certain types of educational objectives, externally paced (oral) instruction without visualization is an effective as visualized instruction for certain types of students.

7. All types of cueing techniques do not equally facilitate the instructional effectiveness of different types of visual illustrations; some types of cueing techniques are significantly more effective than others in externally paced instruction.

8. The effectiveness of a particular type of visual in facilitating student achievement of a specific educational objective depends, in part, on the amount of time students are permitted to interact with the visualized instruction.

Program of Systematic Evaluation - Phase 3

Research has shown that systematically designed and developed visualization properly integrated into regular instructional training sequences can significantly improve learner information acquisition of designated educational objectives. However, merely integrating visualization alone into an instructional sequence is not always a sufficient condition for maximizing student achievement of all types of objectives. In many cases, visualization must be used on conjunction with one or more additional independent variables to significantly increase student achievement from visualized instruction.

The text, Enhancing Visualized Instruction - Recommendations for Practitioners (19) is a collection of 38 published students conducted in the Program of Systematic Evaluation which extends the content found in the text, Strategies for Improving Visual Learning. The main thrust of the research contained in the text focuses on how different independent variables may be manipulated and combined to facilitate increased student learning from visualized instruction In communicating this information the text cites over 950 references,and contains 95 tables and 86 figures. Following is a sampling of some of the types of variables investigated in the studies.

Cognitive trace compatibility
Color coding
Cue summation
Dogmatism
Encoding specificity
Field independence/dependence
Imagery learning strategies
Intelligence
Levels of self pacing
Mode of instruction
Networking
Order of testing
Overt/covert practice
Prior knowledge
Rate modified speech
Realism
Rote learning strategies
Visual testing

Cognitive strategies
Computer based instruction
Cued recall
Elaborate/reduced step cueing
Eye movement
Free recall
Instructional congruency
Interactive/interruptive TV
Locus of control
Motion
Notetaking
Organizational chunking
Post questions
Programmed instruction
Reading comprehension
Rehearsal
Short term/long term retention

These studies investigating the above-cited variables have found that:

- achievement is enhanced when embedded cueing strategies are integrated in computer based instruction;
- learners with higher I.Q.'s learn more from complex visual displays;
- the more elaborate visual cues tend to be most effective;
- visuals possessing varied degrees of realistic detail can be used to reduce differences in the performance of learners possessing different levels of prior knowledge;
- combining visualized instruction and visualized testing improves student achievement;
- learners with higher I.Q. fixate more on complex instructional visuals, and learners with lower I.Q. have fewer fixations as visual complexity increases;
- learners with lower reading comprehension skills learned better with simpler visuals, while learners with higher reading comprehension skills perform better with more complex instructional visuals;
- pre-program question cueing is more effective than motion and arrows in facilitating student achievement of specific educational objectives;
- color coding improves attention, learner motivation, and the formation of structure in memory;
- chunking of information can be a beneficial variable in facilitating student achievement when using imagery learning strategies;

- learners possessing different levels of field-dependence/independence learn quantitatively differ amount of information from visuals which vary significantly in terms of visual complexity;
- imagery strategies involving networking, or information chunking are effective in assisting learners to process new information;
- externally-faced methods of facing computer based instruction were more effective in promoting learner achievement than were self-paced methods;
- different rehearsal strategies impact differentially in facilitating student achievement of different educational objectives;
- visual testing is a valid strategy for assessing students' learning from visualized instruction;
- learners who are given quality interaction opportunities spend more time learning and achieve significantly better on tests measuring specific educational objectives;
- amount of rehearsal activity provided to students significantly influenced the performance of students identified as external locus of control;
- the addition of audio redundancy to an instructional sequence has a significant negative effect on the achievement of learners identified as being in the low I.Q. level.

The Future

Although the scope of the Program of Systematic Evaluation has expanded to take advantage of new advancements in technology, the main emphasis has been at the tactical and strategy levels where manipulation of the independent variable and its subsequent effect on student information acquisition has been the focal point. This type of information is considered to be critical to the instructional designer whose ultimate goal is to design those instructional conditions which have a high predictability of promoting predetermined levels of achievement for specified audiences.

The Program of Systematic Evaluation will continue to take advantage of recent advances in technology while continuing to explore visualization as an interrelated constituent process. Research currently in progress is utilizing microcomputer capabilities. Plans are also in place to expand efforts into the areas of interactive video. Present interests indicate that research will continue to extend to the public school environment in such areas as communication, visual literacy, and computer literacy. At the corporate level adult learning programs will continue to utilize the experimental treatments to establish base line data for varied training programs charged with being responsive to different audiences. At the college level it appears that the research interest will be multi-focused and will continue to explore the instructional effect of intervening variables used singly and in combinations--to assess their influence in incrementally improving student information acquisition. It is anticipated that this research will become more comprehensive in nature and continue to employ the most sophisticated, statistical techniques available.

International use of translated instructional treatments will continue to expand. Research utilizing the experimental materials is currently being conducted in Africa, Brazil, China, Egypt, and South Korea. It is hoped that, through The Program of Systematic Evaluation, prescriptive guidelines will eventually be developed which will identify those generic conditions which must be attended to by designers of instructional materials to maximize student information acquisition.

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Effect of Presentation Rate on Immediate Recall of Concrete Nouns Using Imagery

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The efficacy of imagery instruction in paired-associate tasks has been demonstrated by Bower (1972), Atkinson (1975), McGivern and Levin (1983), Pressley, Levin, and Delaney (1982), and Newby, Cook, and Merrill (1988). However, one aspect that is not clear in these investigations is the presentation rate(s) that will optimize performance under an imagery or non-imagery condition.

The research on mnemonically-mediated learning has yielded mixed results in regard to optimal presentation times. For example, Bugelski (1970) contended that a 2 second per item presentation is inadequate for effective image generation in paired-associate imagery studies. He maintained that subjects needed from 4 to 8 seconds for a useful image to be formed. Belleza (1981) suggested that the failure to find evidence of mnemonic effectiveness in some experiments could be attributed to failure to use sufficiently slow presentation times (2-4 seconds per word pair being too rapid).

In contrast, Hall and Fuson (1986) found that there seems to be a substantial decline in processing effectiveness for the control group when a list item is presented for a period beyond a very small number of seconds (i.e., beyond 2-4 seconds per pair). They contended that the use of relatively slow presentation times, 8-10 seconds per pair, for the study of a mnemonic technique (the *keyword method*) has led researchers to overestimate the mnemonic facilitation. They held that this is because the slow presentation has a deleterious effect on the learning of the no-strategy control group, whose learners do better with more rapid presentations. However, Pressley (1987) found that university students learned better with the *keyword method* than did no-strategy control subjects, with either a single presentation of the list at a rate of 9 seconds per word pair or three consecutive presentations at rates of 3 seconds per pair.

Visual literacy is concerned with the individual's application of learned knowledge and skills to the interpretation of new visual experience. In short, it is the "active reconstruction of past visual experience with incoming visual messages to obtain meaning" (Sinatra, 1986). In paired-associate tasks, the presentation time and study condition are affecting the individual's construction of the memory of the stimulus words and associated images.

Clearly, additional research is needed to clarify the relationship between the rate of presentation and the learning method, especially since many instructional programs involve the paced presentation of materials. The present experiment, a paired-associate memory task involving four different study conditions (self-generated images, supplied images, repetition, or self-determined strategy) and three different presentation times (2, 4, or 8 seconds per word pair), should provide a useful clarification of these issues.

Method

Subjects and apparatus

Seventy-two students from introductory Psychology classes at the Virginia Polytechnic Institute and State University volunteered for this investigation. They received course credit points for their participation in the experiment. Twenty pairs of concrete nouns (Table 1) were selected for high imagery and concreteness from a list of nouns that had been normed for concreteness, imagery, and meaningfulness by Paivio, Yuille, and Madigan (1968). A random order of presentation was determined for nineteen of the noun pairs. One pair served as practice.

All presentations of noun pairs and testing were conducted individually on an Apple Macintosh microcomputer. The study condition and presentation rate were controlled by a Macintosh Pascal program. The pictures for the *supplied images* study condition (Figure 1) were generated by graphics commands in the Pascal program. All responses were made with pencil on an answer sheet.

Table 1

Pairs of Concrete Nouns in the Order of Presentation and Testing

Order	Stimulus noun	Response noun	Order	Stimulus noun	Response noun
Practice	BOARD	CHAIR	11	FLOWER	BOOK
2	CANE	HOUSE	12	PENCIL	FORK
3	MICROSCOPE	DIAMOND	13	CLOCK	MISSILE
4	NAIL	BOWL	14	TREE	BUILDING
5	PAPER	DOOR	15	TOWER	GRASS
6	CAR	HAMMER	16	PIPE	TABLE
7	ARROW	BOTTLE	17	COIN	INK
8	COFFEE	FIREPLACE	18	LETTER	UMBRELLA
9	ENGINE	KEG	19	POLE	TICKET
10	STAR	WINDOW	20	PIANO	YACHT

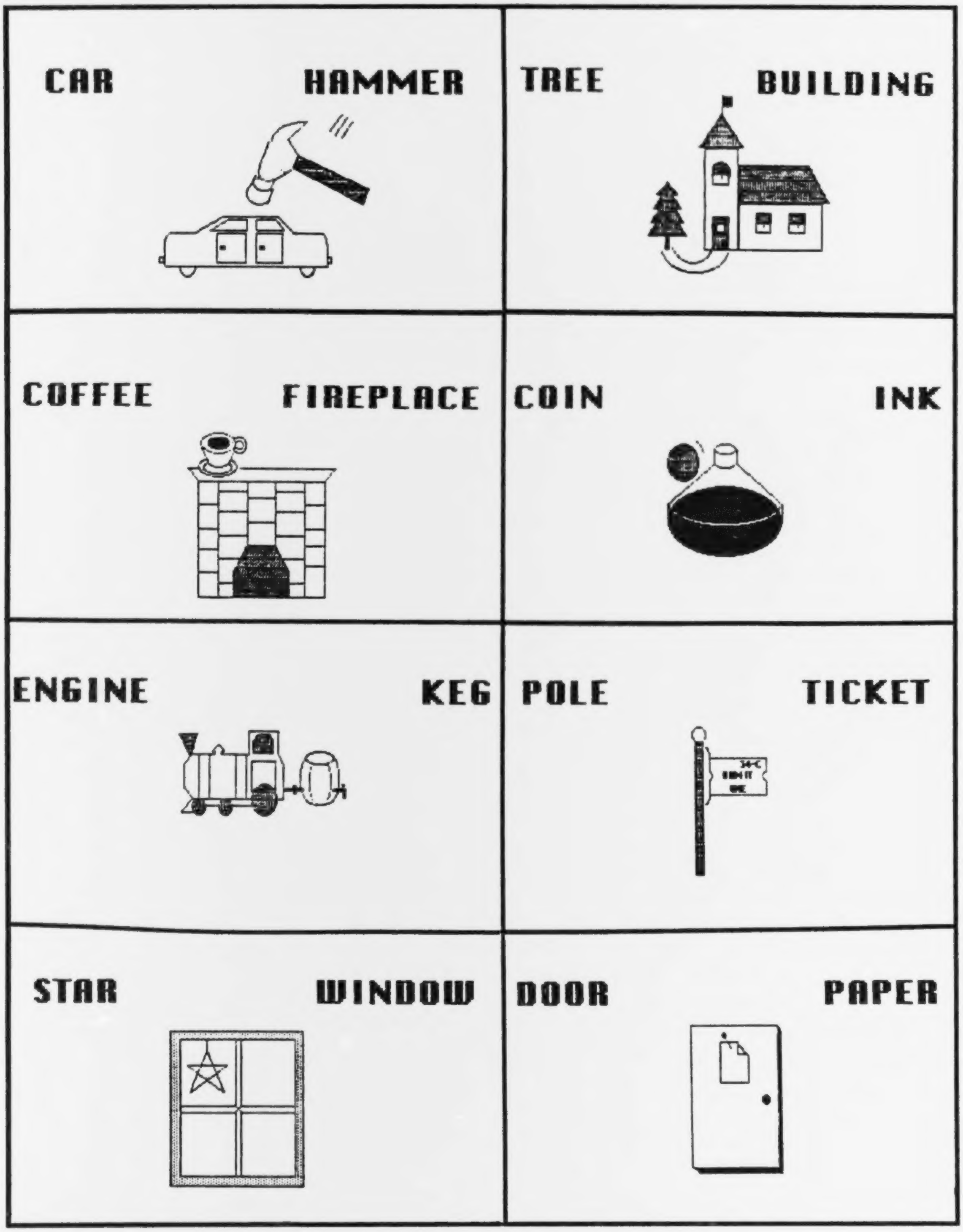
CAR
HAMMER
TREE
BUILDING
COFFEE
FIREPLACE
COIN
INK
ENGINE
KEG
POLE
TICKET
STAR
WINDOW
DOOR
PAPER

Figure 1. Sample of pictures and noun pairs for the *supplied images* study condition.

Procedure

Groups. The subjects were randomly assigned in a 4 X 3 factorial design which incorporated the four study conditions (*self-generated images* , *supplied images* , *repetition* , or *self-determined strategy*) and the three presentation times (2, 4, or 8 seconds per noun pair).

Instructions. All subjects were presented with a standard set of instructions that specified that the experiment was concerned with learning pairs of nouns. Subjects with the *repetition* study condition were directed to learn the noun pair by repeating the words silently. Subjects with the *self-generated images* condition were directed to learn each noun pair by forming a mental image linking the words. Subjects with the *supplied images* condition were directed to learn each noun pair by remembering the accompanying image (Figure 1). Subjects with the *self-determined strategy* condition were directed to learn each noun pair however they chose. For practice, each subject was presented one noun pair, CHAIR-BOARD, in its presentation format and then in its testing format, CHAIR.

Presentation. During the presentation for all study conditions, the subject sat at a table across from the microcomputer about 2.5 feet from the screen. The nineteen noun pairs were presented to all subjects in the same random order. For the *self-generated images* , *repetition* , or *self-determined stategy* study condition, the software presented the noun pairs on the screen at the assigned rate. Each pair was laid out horizontally near the vertical center of the screen with each noun centered on its half (left or right) of the screen. For the *supplied images* study condition, the software presented each noun pair in the same screen position as above, with an image shown below the words (Figure 1). Each image showed a picture for one noun interacting with the picture for the other noun.

Testing. Immediately following the presentation for each study condition, the subject was presented the first noun of each pair and asked to write that word and the noun that had been matched with it. These stimulus nouns were presented with a time of 10 seconds per word, near the horizontal and vertical center of the screen, in the same random order as for the presentation of the noun pairs. A subject's response was scored as correct only if the second noun of the original pair was written.

Interviewing. Upon completion of the testing, self-reports were obtained from subjects in each of the four study conditions.

Results

For the six subjects in each study condition at each presentation time, Table 2 shows the mean number of correctly recalled nouns (out of 19) and the standard deviation. These means are plotted as a function of study condition and presentation time in Figure 2.

An analysis of variance (Table 3) was conducted on the mean number of correctly recalled nouns as a function of study condition and presentation time. There was no interaction between study condition and presentation time. The Tukey HSD test, with alpha of 0.05, was employed for a post hoc analysis of significant differences. Across presentation times, immediate recall was significantly improved as the presentation time increased. Across study conditions, recall differed significantly between only (a) the *repetition* and the *self-generated images* study conditions, and (b) the *repetition* and *supplied images* study conditions. Recall with the *self-generated images* and *supplied images* study conditions was better than with the *repetition* condition.

Table 2

Mean Numbers of Word Pairs Recalled as a Function of Experimental Condition

	Presentation time for each noun pair (in seconds)		
Study condition	**2**	**4**	**8**
Self-generated images			
N	6	6	6
M	9.2	16.2	17.8
SD	2.8	2.7	1.5
Supplied images			
N	6	6	6
M	8.0	11.8	16.5
SD	4.3	2.9	2.5
Self-determined strategy			
N	6	6	6
M	5.2	12.0	15.2
SD	2.9	5.7	4.0
Repetition			
N	6	6	6
M	4.7	7.0	12.5
SD	4.0	7.0	6.2

For the *self-generated images* and *supplied images* study conditions, all nineteen noun pairs were not equal in their frequencies of being recalled. The noun pairs with the highest frequencies of recall were CANE-HOUSE, MICROSCOPE-DIAMOND, STAR-WINDOW, FLOWER-BOOK, and PIANO-YACHT. The noun pairs with the lowest frequencies of recall were ENGINE-KEG and POLE-TICKET.

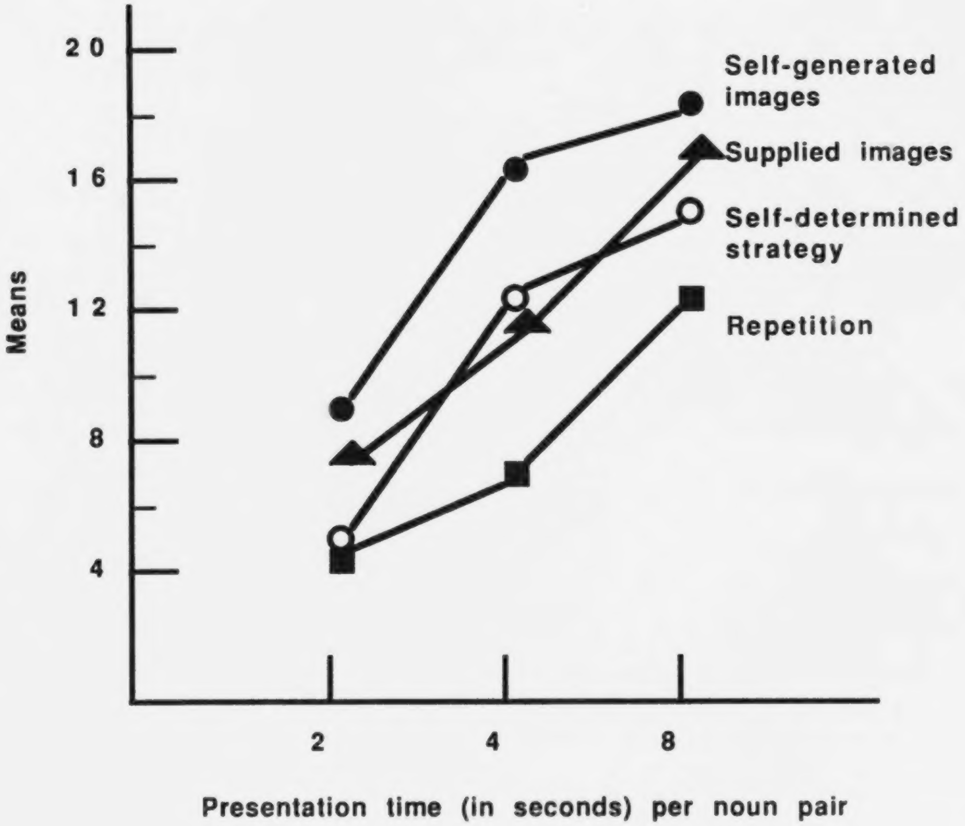

Figure 2. Effect of presentation time and study condition on mean number of noun pairs recalled.

Discussion

The fact that for the *self-generated images* and *supplied images* study conditions, all nineteen noun pairs were not equal in their likelihood of being recalled, may indicate that some pairs lent themselves more readily to the mental generation and processing of images, respectively. In the post-testing interviews, several subjects reported finding difficulty in formulating or recalling visual associations between ENGINE and KEG, and between POLE and TICKET. Several subjects reported easily formulating or recalling visual associations between CANE and HOUSE (e.g., "sugar cane" and a "gingerbread house"), MICROSCOPE and DIAMOND (e.g., "looking through a microscope at a diamond"), STAR and WINDOW (e.g., "looking through a window at a star"), FLOWER and BOOK (e.g., "a book with flowers on the cover"), and PIANO and YACHT (e.g., "someone playing a piano on the deck of a yacht"). More extensive interviewing of subjects might provide more insight into which types of images were most easily generated and recalled.

Although immediate recall for the control (*self-determined strategy*) study condition was inferior to that of either imagery condition at the 2 second presentation time, it was practically identical to that of the *supplied images* condition for 4 second and 8 second presentation times. Interview data for several subjects in the *self-determined strategy* condition indicated that they had employed *repetition* for the first 3-5 noun pairs, and then used *self-generation of images* for most of the remaining pairs. This might explain the similarity at 4 second and 8 second presentation rates of recall for the *self-determined strategy* and *supplied images* conditions. More extensive interview data might shed more light on this congruence of recall for the *supplied images* and control conditions at longer presentation times.

Table 3.

Analysis of variance summary for the mean number of noun pairs recalled as a function of study condition and presentation time

Source	df	SS	MS	F	Pr
Condition	3	377.89	125.96	7.16	0.0003 *
Time	2	925.00	462.50	26.30	0.0001 *
Condition X Time	6	53.78	8.96	0.51	0.7987
Error	60	1055.33	17.58		
Total	71	2412.00			

Optimal recall for the *self-generated images* study condition occurred for 4 seconds per noun pair, with no appreciable increase in learning for the 8 second presentation time. This result was consistent with the findings of Bugelski (1968) that 4 seconds or more were require dto create images from pairs of words.

In contrast to Hall and Fuson (1986), our results did not show a substantial decline in processing effectiveness with increasing presentation time for any study condition. The *self-generated images* study condition is similar to some aspects of the *keyword* method in that they both involve imagery links. Performance increased for all study conditions with increasing presentation time. If our *self-generated images* study condition is indeed comparable with the *keyword* method, then our results parallel those of Pressley (1987) in that the subjects learned better with the *self-generated images* study condition than did control (*self-determined strategy*) subjects at all presentation rates. There was no interaction between presentation time and study condition.

We feel that the present study has suggested nearly as many new questions as those it has answered. Would recall increase with multiple presentations at faster presentation rates? For imagery studies, does the "total-time hypothesis" hold, where "a fixed amount of time is necessary to learn a fixed amount of material regardless of the number of individual trials into which that time is divided" (Cooper & Pantle, 1967)? We are in the process of investigating these issues.

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Teaching Visual Literacy Through Art History in High School

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The appropriateness of art history in high schools is based on the importance of visual ideas today and throughout history. A dramatic contemporary example exists in the interest in visual media that adolescents seem to thrive on. History, expressed through visual language, is brought to being as adolescents decipher the visual characteristics of a work of art. They discover how metaphors, allegories and symbols convey values, attitudes and beliefs. Students learn how the artist felt about a theme, a subject, a person or an event and identify with his thoughts on life.

Visual literacy is an essential component of art history. Today, high school students are continually bombarded with visual information through a variety of media. Images on television, (especially music television), in film, and in advertising leave lasting impressions that affect how adolescents think and behave. The consumption of pop culture notwithstanding, much of what young people experience through the mass media is passive or vicarious rather than interactive (1). In schools they are actually taught how to relate to verbal ideas, but have limited means by which to make sense of a world inundated with visual imagery.

We are most dependent on our visual sense to "read" our environment. This visual mode of knowing enables us to perceive what is going on in the world (2). And yet, from the earliest grades in schools we are taught to interpret verbal and mathematical symbols. Our ability to read and understand the visual characteristics of our environment is for the most part ignored or left to chance. Yet, visually literate adolescents can better discriminate among and judge the aesthetic merit of their visual experience. Furthermore, visual literacy can lead to the development of a critical consciousness that will enable adolescents to make responsible choices about how they will interact with society.

Thus, the focus of this paper will be on the important of teaching visual literacy through art history to high school adolescents. Four aspects will be discussed; first, some commonalities between verbal and visual language; second, steps in art criticism that teach adolescents how to "read" works of art and understand their place in history; third, a form of criticism that takes students beyond literacy toward creative thinking; and fourth, a classroom performance demonstrating the use of visual literacy toward creative ends.

Verbal and Visual Language: Some Commonalities

Notwithstanding their obvious differences, verbal and visual language have in common specific elements and principles of expression. In the branch of linguistics known as semiotics, words comprise the basic elements. A collection of words constitutes a vocabulary, which is derived from the French *vocable* and the Latin *vocabulum*, meaning "list of words and their meanings"(3). Without knowledge of words or a vocabulary it would be difficult for any student to read and understand a verbal form of expression. The following passage from James Joyce's poem *Chamber Music*, for example, contains words whose meanings must first be understood in order to appreciate its message.

> Winds of May, that dance on the sea
> Dancing a ring-around in glee
> From furrow to furrow, while overhead
> The foam flies up to be garlanded,
> In silvery arches spanning the air,
> Saw you my true love anywhere?
> Welladay! Welladay!
> Love is unhappy when love is away! (4)

Reading the passage, we experience principles of composition that Joyce has employed to achieve balance, harmony and movement with the words. "The arrangement of words in their appropriate forms and order" refers to "syntax" after the Latin *syntaxis*, meaning "to arrange"(5). Thus, the words in the poem are arranged in such a fashion that we can imagine the incoming and outgoing tide of the sea from the sounds and rhyme of words. The poem evokes an atmospheric feeling of air, water and mist moving in harmony like the ebb and flow of feelings between lovers.

Visual language conveys meaning through the use of elements and principles of expression. In the visual arts, for example, line, shape, color, texture, value and space comprise a basic set of design elements. Like words in verbal language, their infinite variations constitute a visual vocabulary. Curved, jagged or wavy lines express different qualities of feeling - different ideas. Geometric shapes, as compared with rounded or curvilinear shapes, convey feelings of hard versus soft. Similarly, rough versus smooth textures, light versus dark values of color, and the use of space convey qualities of feeling through their respective forms.

Thus, the development of verbal and visual literacy is dependent upon reading and understanding the basic elements and principles of expression. Visual literacy also requires the ability to use verbal language both in spoken and written form to communicate the experience of art. In the next section, I will discuss a process for developing visual literacy through description formal analysis, interpretation and judgement of art works.

Reading Works of Art Through Art Criticism

Art history requires an understanding of art from both historical and experiential referents. History informs adolescents of where, when and why an art work originated. As they study a work of art, they learn to appreciate its form and its visual qualities. The experience of art requires empathy - the ability to identify with its visual character. On a more profound level, experience is deepened by skills in art criticism: the ability to describe, analyze, interpret and make judgements, as suggested by Edmund B. Feldman in Varieties of Visual Experience. The art history/criticism connection is supported by art historian Howard Risatti, who tells us that art criticism "naturally draws upon and is interrelated" with art history (6). Therefore, by studying art history in high school, adolescents can become visually literate as they experience art and its history.

Feldman's steps in art criticism serve as an important mode for teaching visual literacy to adolescents. First, by describing a work of art, adolescents learn to identify and read its visual elements -- its vocabulary. According to Feldman, description is the "process of taking inventory, or noting what is immediately present to the viewer" (7). This skill can be taught in a high school art history course through an inventory assignment, which might result in lists containing as many things as students can find about a work of art.

In taking an inventory of Auguste Rodin's sculpture The Kiss (1898), for example, students might describe nude figures of a man and woman in a passionate embrace at the moment before their lips are about to touch in a kiss. Upon further examination, they would find that the figures are rendered in curved lines, rounded shapes, and soft-smooth textures. These elements in Rodin's sculpture express feelings of passion, love and eroticism. Like the words in Joyce's poem, they too must be visually read and understood in order to appreciate Rodin's message about love.

Next, as students engage in a formal analysis of the sculpture, they describe the arrangement and interaction of the visual elements. As principles of composition employed by the artist, they can be considered the syntax of art. For Feldman, formal analysis takes place when

> We endeavor to go behind the descriptive inventory to discover how the things we have named are constituted...we describe the relationships among qualities of line, shape, color and illumination which are responsible for the descriptive inventory (8).

Through formal analysis, students explore the arrangement of visual elements in Rodin's sculpture. Similar to syntax in language, principles of composition were used by the artist to arrange the visual elements in his work. Thus, continuing to build on their inventories, the elements listed by students can now be linked together in terms of their balance, harmony, movement, variety and proportion.

For example, The Kiss contains a variety of soft, rounded forms representing the anatomical proportions of the two figures. The softness is also suggested by the reflection of light off the smooth texture of the forms and their gentle rhythmic flow. Unified by their embrace, the two figures appear as one. The vertical lines of the legs move our attention upward to the point of intersection with the diagonal and horizontal lines of the arms and shoulders. We are then visually propelled upward to the focal point of the work, created by the lines of the wrapped arms of the figures demarcating a private space where "the kiss" is about to take place.

Up to this point, students are asked to focus on the visual elements and the principles of composition intentionally to prevent a gestate from taking a place -- this, in order to understand the components of communicative visual expression. Students then apply Feldman's third stage of art criticism; interpretation, in which they begin to unify the visual characteristics deciphered from the work of art. Feldman states:

> As we perceive the work, its formal and other qualities seem to organize themselves into a kind of unity, and it is this unity which becomes the meaning of the work (9).

In essence, interpretation requires that students incorporate their experience and understanding of visual forms into a unified meaning or concept. In addition, they begin to link the visual experience of the work with its historical background.

An interpretation of Rodin's sculptural forms suggests both a tender and erotic relationship between the two lovers in The Kiss. As they lean slightly back and into each other, their bodies suggest a romantic vulnerability -- perhaps the resolve of ecstasy. Rodin's sculpture depicts the two lovers Paolo and Francesca, described in Dante's inferno, who were killed by Francesca's husband after he discovered their secret love affair. Interpreting Rodin's depiction of Dante's story, art historian Albert E. Elsen states:

> (Rodin) handled the embrace with the utmost tact, the lips are not yet touching, and Paolo's right hand rests tentatively on Francesca's thigh, while the left still holds the book behind her back. One can sense conflicting feelings in Paolos' body; he was the brother of his lover's husband, who had asked him to tutor Francesca. It is Francesca who seems the most ardent, and it is she who slings her leg across that of her partner as a symbol of desired sexual intimacy (10).

In this interpretation, Elsen provides a verbal characterization of Rodin's sculpture and reveals a significant relationship between visual and verbal literacy. Students incorporate description, analysis and interpretation with verbal communication.

Finally, Feldman refers to his last art criticism objective as judgment. He characterizes it as

> ascertaining the purpose or function of a work; relating the work to the widest possible range of similar works; determining in what ways the present work was continued or departed from historical prototypes: relating the work to the characteristic needs and outlook of the time in which it was created (11).

Herein lies the important link between art history and criticism and their contribution to visual literacy. Art criticism is a process of experiencing works of art and understanding their expressive character. Once this knowledge is gained, it is then important to learn the functional and historical contexts from which works of art have originated. This contextualizing process constitutes judgment.

In judging The Kiss, we find that Rodin first modeled Paolo and Francesca around 1880-1881 for his monumental achievement, The Gates of Hell. The solitary nature of the figures did not fit with the totality of The Gates, so Rodin decided to exhibit a half-size plaster without a title. By 1898, when the French government commissioned to have the plaster carved in marble, the sculpture's title had undergone several suggestions by writers and critics.

Rodin was a prolific sculptor. The many works that he created during his lifetime were unique, yet difficult to assign to any particular school of artistic thought such as romanticism, realism or impressionism. Nonetheless, works like The Kiss represent the spirit of change in the late nineteenth and early twentieth centuries. In that period of social, political, economic, and artistic revolutions Rodin's figures represent a rejection of traditional values and what remained in their place were existential questions. Thus, Rodin's Paolo and Francesca succumb to their desires and through their indiscretion develop a futile relationship that eventually results in their deaths.

Twentieth century sculptors Constantin Brancusi and Alberto Giacometti sought inspiration from Rodin in creating their own interpretations of The Kiss. Thus, by judging a works of art similar to The Kiss, high school students relate their formal analysis and interpretations to a wide range of historical ideas and to their own views on life as they mature into adulthood.

Beyond Literacy Toward Creative Thinking

As we have seen, Feldman's model of art criticism is based on an historical approach. He begins by decoding the visual characteristics of an art form and ends by placing it in a context of art history. This sequential process teaches students skills in literacy, criticism and history that are undeniably important for intellectual development.

Nonetheless, many contemporary artists like sculptor Luciano Fabro believe that the purpose of their work is to go beyond art history by revealing the process of artistic thought. Characterizing this artist's philosophy, critic Germano Celant writes:

> According to Luciano Fabro, sculpture is a metaphor and allegory for sculpting. The artist, then, rather than cultivating his or her own identity, must pay attention to art's identity; must face the immensity of a flood of "things"; must question everything that seems to have been already thought out; must be willing to travel from rhetoric to linguistics to reveal the process of creativity itself (12).

Fabro's conception of sculpture requires a strong understanding of art history and criticism, yet an equally strong desire to go beyond the traditional assumptions of art.

Similarly, deconstructionist critics view an historical approach to art criticism as confining and repressing linguistic expression (13). Instead, they call for a critical method that liberates the language of art from historical contexts to be used in new and creative ways.

Beyond Feldman's approach visual literacy needs to concern itself with creative thinking. This can be achieved through a form of criticism that enables adolescents to *deconstruct* their history-based knowledge by creating "contradictory models of significance and interpretation" (14).

Deconstructive criticism, according to deconstructionist critic Jonathan Culler, does not attempt to destroy the traditional assumptions of art history which students have learned through a process like Feldman's, but rather to undo and displace them, to situate them differently (15). He further states:

> ..deconstruction emphasizes that discourse, meaning, and reading are historical through and through, produced in a process of contextualization, decontextualization, and recontextualization (16).

Thus, while Feldman's historical approach and deconstruction are different, they are complementary. By extending Feldman's approach to include deconstruction, historical art concepts can be appropriated for creative uses. That is, art's language can be used beyond the traditional assumptions of visual art.

Arthur Koestler's notion of "bisociation" illustrates the conceptual workings of deconstruction and its ability to liberate both visual and verbal language. Bisociative thinking takes place when the student is asked to empathize with a contradictory or unrelated set of assumptions like a pun or paradox. The empathy with one set of assumptions cannot be transferred to the other set, thereby creating a bisociative pattern where the two or more opposing ideas are conceived simultaneously. It is out of this mental process that creative thinking develops according to Koestler (17).

Furthermore, Koestler characterizes bisociative mental patterns as "underground games" that follow a "grammar and logic of dream-cognition" (18). They are

> ..the *pun*: two strings of thought tied together by a purely acoustic knot; the *optical pun*: one visual form bisociated with two functional contexts; the *phenomenon of displacement* or shift of attention to a previously unnoticed feature; the *concretization* of abstract and general ideas in a particular image; and vise versa, the use of concrete images as *symbols* for nascent, unverbalized concepts; the *condensation* in the same link-idea of several associative contexts; the unearthing of *hidden analogies*; *impersonation* and double identity -- being oneself and something else at the same time, where the "something else" might belong to the animal, vegetable, or mineral kingdom (19).

Similarly, linguist Walter Redfern points to the "inflexibility of language" and the importance of wordplay in the history of creative thought (20). In his book *Puns* he states:

> The key movement of the pun is pivotal. The second meaning of a word or phrase rotates around the first one. Or branches off from it; puns are switch words, like pointsmen at a junction...pivotal wordplay enables (a

story, an idea or a theme) to bifurcate (and later to double back on itself) (21).

Bisociative patterns are not limited to Koestler's list. One can go on forever identifying the paradoxical workings of the human mind. What bisociative patterns illustrate are deconstructive operations that enable adolescents to play with visual ideas learned in art history and to create new meanings with them.

Creative Literacy: A Classroom Example

An example of deconstruction was performed at the high school where I formerly taught studio art and art history. Three students from my art history class, who were participating in a mixed media performance workshop, decided to create a performance that resulted in deconstructing adolescent courtship rituals that occurred annually during the spring semester when "spring fever" prevailed over the school. Using the act of "kissing" as their subject, they wrote, directed and performed a deconstruction of its traditional assumptions and invented a new way of doing it. The following describes the performance Lip-Stick as it was presented before a live audience at the high school.

The students brought the following materials, objects, and equipment to the performance space:

1. A 4"x 4"x 6′ wooden post, painted white
2. A metal hook
3. Some rope
4. Four tubes of "passionate red" lipstick
5. An audio tape cassette and recorder
6. Three photo floodlights

Using these elements the students produced the performance expressing adolescent passion on campus. One end of the white wooden post was tied with the rope and suspended vertically from a hook in the ceiling to approximately six inches from the floor. The tape recorder was plugged into a wall socket and placed directly beneath the suspended post.

The students then invited me to join their group as a participant. The four performers -- two women and two men -- each faced one side of the post with a person of the opposite sex on the other side as a "kissing partner." The post, which blocked our view of each other, was the "pivotal" point of the performance.

Each participant was given a tube of lipstick and a set of instructions by one of the students. Facing the post in a prone position, we applied the lipstick to our lips and "pressed" them against the post in order to produce a print of our lips on the "Stick" (the post). The post, being suspended from the ceiling, had to be stabilized to keep it from swaying back and forth from our actions. Without using our hands we coordinated and positioned our bodies to hold the post in place so that we could apply pressure with our lips onto its surface.

Each kiss was accompanied by a loud "smack" to record the sound of the kissing on tape. The absurdity and awkwardness of the gesture caused giggling and laughter among the participants. The laughter and rustling of bodies during the entire process, accompanied by the smacking of the kisses, provided a playfully erotic backdrop of sound. The activity of printing "lips-on-a-stick" continued the length of the post until we were unable to reach any further with our lips. The performance then ended and what remained was a "stick-of-lips" and the documented sound on tape.

The focus then shifted to an historical mode of criticism. Recontextualizing Lip-Stick, we discussed its relationship to the following works:

1. The Kiss by Rodin
2. The Kiss by Brancusi
3. The Couple by Giacometti
4. The Couple by Magritte

Lip-Stick was a parody and deconstruction of the romance displayed on the high school campus, and of visual language. The students who created the performance had come to terms with the salient characteristics of holding hands, hugging and kissing on campus. Through the performance of a visual pun, they temporarily diverted attention from traditional assumptions about art and kissing, only to create a new one (22).

Through a process of art criticism that includes description, formal analysis, interpretation, judgment, and deconstruction students learn the language of art, its historical significance, and its use in creative thinking. Art history in high school provides the context for developing visual literacy and creative thought. It thus provides students with knowledge about the disciplines of art history and criticism. Therefore, in addition to studio classes, courses in art history and criticism are recommended for high school art programs.

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Critical TV Viewing Skills: A Paradigm for Program Development

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The students in my undergraduate class in instructional media were actively involved in this lesson. They had just seen a film, "Kids for Sale" (Cinema Graphics, Inc., 1979). The film presents a dramatic account of the impact of television on the lives of young children. It details the selling of products to very impressionable minds with the concomitant message to spread the "good news" to parents and peers. In short, the children's commercial was designed to produce faithful salesmen for the advertised products. After the showing, a brisk and very cerebral class discussion ensued. With emotionally charged comments, students analyzed the pro's and con's of commercial television.

To fuel the debate, numerous studies have been conducted describing the impact of television viewing. For example, the published report, Television and Behavior: Ten Years of Scientific Progress and Implications for the Eighties (1982), produced by the U.S. Department of Health and Human Services, described a plethora of negative factors associated with television viewing. This comprehensive research study indicated that heavy viewing is related to a decrease in creativity and an increase in aggressive acts with young children. In addition, the time spent viewing television resulted in fewer hours devoted to homework. Based upon this major review of research, the negative results described in this study far exceed the positive impact of the medium.

However, Kate Moody (1980) analyzed some important positive outcomes of commercial television viewing. For example, television characters can model constructive, positive social behavior like caring, sharing, and helping, as evidenced in Mister Roger's Neighborhood. In addition, basic mathematics is frequently presented in dynamic fashion in Sesame Street and in other PBS broadcasts. Current events, via the news, can also bring salient concepts from geography, sociology, psychology, economics, political science, etc., directly to the child's living room. In addition, TV sports can graphically depict outstanding athletes displaying exemplary methods and form. The medium can be an outstanding source for role models especially in the athletic domain. Dramatic presentations on TV also can be used as a catalyst to introduce outstanding literature to young people.

Just as television can be used in a constructive manner in the home, so can it be used by the classroom teacher to meet a variety of cognitive, psychomotor, and affective objectives. By careful preparation of students for the viewing, by encouraging participation during the program, and by using stimulating follow-up learning activities, teachers can more effectively use the medium. This process contains some of the key concepts involved in the critical television viewing skills approach (CTVVS)-- a plan which endeavors to focus on the positive aspects of television programming to produce critical TV consumers. The goal of the program is to produce a sophisticated consumer, one that can extract the positive elements out of TV and leave the "shaft" alone.

Defining Critical Television Viewing Skill

The U.S. Department of Education has defined CTVVS as "those factors which enable persons to distinguish among a wide range of program elements so they can make judicious use of their viewing time." To illustrate this construct, the government listed a group of essential competencies (1978):

- To understand the psychological implications of commercials.
- To distinguish fact from fiction.
- To recognize and appreciate differing and/or opposing points of view.
- To develop an understanding of the style and content of dramatic presentations, documentaries, public affairs, news and other television programming.
- To understand the relation between television programming and the printed word.

Frank Withrow (1980), Department of Education, believed that CTVVS enabled students to make judicious uses of television as an information source and as an entertainment form. Moreover, he stated that the CTVVS should involve both knowledge and activities.

The federal government selected four agencies to develop the curriculum materials. The Southwest Educational Development Lab developed the K-5 program; WNET, public TV in New York, was responsible for the construction of the middle grades curriculum; the Far West Laboratory for Educational Research and Development planned the high school program; and Boston University's School of Public Communication developed the materials for adults.

CURRICULUM CONCERNS

Where to locate the CTVVS program in the curriculum is a major concern of curriculum developers. The agencies that produced the CTVVS programs usually recommend that it be included in the language arts or social studies curriculum in the elementary school. On the secondary level, they suggest that critical TV literacy skills should be included in the social studies curriculum or in a separate elective course. An alternative approach would involve the integration of CTVVS with the total K-12 curriculum. Proponents of this strategy like the status quo. Without a deliberate emphasis, total integration with the current school curriculum probably would result in minor impact on students. To produce critical TV consumers, an integrated program, K-12, in the area of language arts or social studies seems to be the most effective means of implementation.

The first step in the implementation process focuses on those who will be the vital link between the program and the children, and the program and the parents--the teachers. Staff development is paramount. The teachers need to be wise-users of television themselves, or, at the very least, aware of the principles underlying the discriminative use of television. They need to be informed of the ways in which critical television-use can enhance their curricular goals in the classroom, and of the necessary skills involved. Above all, a strong and enthusiastic commitment to such a program is required of those who will be the leaders in this endeavor.

Secondly, a team of administrators, curriculum specialists, and representative teachers must judiciously examine the many different program thrusts and formats that are currently on the market for this purpose. This is a time when general goals and specific objectives must be intertwined with a knowledge and understanding of the specific setting and situation. The team must keep in mind, also, that many programs are flexibly designed so that they can be used either as a whole or as individual instructional units.

Thirdly, strong parental involvement is dictated. A program of this nature will have little chance of success if the parents do not endorse and embrace it wholeheartedly. They need to be aware of some of the devastating effects of indiscriminate TV use on children and youth; and, at the same time, made conscious of the potential of TV for enhancing learning. They will need to understand the program that the school has adopted and be knowledgeable about ways in which they can be "implementers" in the home. Since most TV viewing is done at home, an active and cooperative relationship between home and school is crucial.

Another consideration is the equipment that will be required. Fortunately, however, there is usually little preparation that is called for here, and a minimal outlay of money. Most schools already possess all of the necessary equipment: cameras, receivers, and video cassette players.

CTVVS CURRICULUM MODEL

Figure 1 depicts an eight part curriculum model which can be used as a paradigm for the integration of CTVVS concepts with the language arts curriculum. The steps in the model will result in the development of a comprehensive curriculum containing essential elements from both language arts and CTVVS programs. In many areas, the goals are very similar and require only a change in activities, not content. This is because the process of becoming a critical consumer of television is very much like that of becoming a critical reader of literature.

The first step is to compare language arts curriculum goals with those of the CTVVS program. A review of national CTVVS curricula and supporting materials, along with local language arts curriculum guides, will assist in performing this analysis. The end result of this initial effort will be a listing of common curriculum goals. These constructs will represent the essential elements in a fused program. In addition, separate CTVVS program goals may need to be developed to complete a balanced curriculum.

Next, curriculum specialists need to develop a list of integrated goal statements encompassing both areas. These constructs will then become the focus of the new, integrated language arts curriculum.

From the goal statements, a comprehensive content outline should evolve. The concepts need to address the usual content areas of reading, writing, grammar, speech and literature. The national CTVVS curricula have produced content outlines which can readily be adapted for this purpose.

A concept map can then be created as a tool that can further assist in clarifying the relationships among language art elements and constructs in CTVVS programs. An integrated model would be most helpful to curriculum specialists.

The next step in formulating the integrated program is the development of a scope and sequence chart which encompasses the two areas. Teachers need to know when concepts should be introduced, when they need to be reviewed, and when they should be expanded. A scope and sequence analysis, therefore, is an integral and vital part of curriculum development.

In addition, a comprehensive listing of major learning activities along with relevant teaching strategies and learning objectives adds a major dimension to this curriculum plan. The inclusion of this element provides a teacher with critical assistance in developing this program.

CTVVS CURRICULUM MODEL

COMPARE GOALS IN LANGUAGE ARTS & CTVVS PROGRAMS.

DETERMINE COMMONALITIES.

DEVELOP INTEGRATED GOAL STATEMENTS.

CONSTRUCT CONTENT OUTLINE.

CREATE A CONCEPT MAP.

PRODUCE A SCOPE & SEQUENCE CHART.

SELECT TEACHING STRATEGIES, LEARNING ACTIVITIES & OBJECTIVES.

FORMATIVE & SUMMATIVE EVALUATION.

Fig.1

The final phase is evaluation: formative and summative. As the program is developing, each significant step needs to be evaluated. For example, the integrated goal statements should be critically evaluated by interested participants. Likewise, at the end of the process, the finished curriculum guide needs to be evaluated by a wide array of affected professionals.

In conclusion, CTVVS programs can successfully be integrated into the elementary and secondary school curriculum. With minimal changes to the language arts curriculum, teachers can include CTVVS constructs to produce critical consumers of television, as well as critical consumers of literature. Teachers should not let this opportunity pass them by.

References

Moody, Kathryn. Growing Up on Television. New York: The New York Times Company, Inc.,1980.

U.S. Department of Health and Human Services. Television and Behavior: Ten Years of Scientific Progress and Implications for the Eighties. Washington, D.C., 1982.

Withrow, Frank B. Objectives for Critical Television Skills Curricula, Television and Children, 1980. 32-33.

A Comprehensive Study of the Types of Visuals Used in Business and Engineering Presentations

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Penn State University

Introduction

This study was conducted to determine what type or types of visuals are most frequently used a business presentation. It was hoped that if visual designers knew which type of visuals that were used in the average business presentation, they could design better, more effective visual messages. Data for this study was gathered at the Electronic Imaging Conference in Boston, Massachusetts during November, 1987. Three days of meetings provided an ideal environment for conducting this research. The presenters at the Boston meeting were business people and engineers explaining the technical intricacies of products created and sold by their companies. In most cases the presenters were not sales people, but were people charged with the development of products. The technical nature of the presentations were typical of business presentations made every day in companies.

The audience at this meeting consisted of a group similar to the presenters. They were business people and engineers attending the meeting to gain information about the latest developments in the highly technical professions of electronic publishing, image processing, video imaging technologies, image analysis engineering, and other technical disciplines. A list of the titles of the presentations observed for this study is included in Appendix A.

Methodology

To conduct this study, the author attended 32 presentations during the three day Boston meeting. There were approximately 250 presentations made during the three days of the meeting. The study is comprised of 31 presentations which were chosen at random by the author.

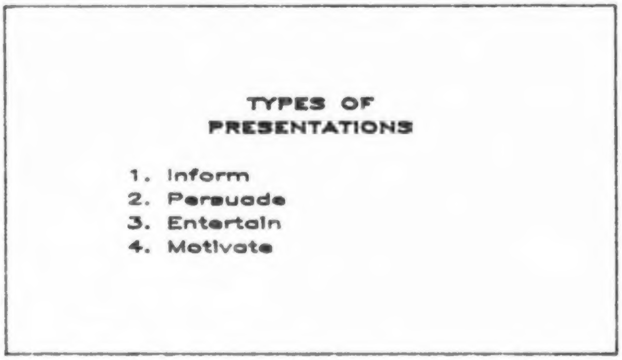
The author followed a two stage process when compiling data on each of the 31 presentations. The first step was to record the medium used to visually support the presentation. Twenty seven of the presenters used either 2x2 slides or overhead transparencies. Three used no visuals; these presentations were calculated into the final results.

In the one remaining case a video tape was played as a presentation. This was done because the presenter was unable to attend the meeting and he sent the video in lieu of his attendance. This video taped presentation was discarded from the study data because this method was seen as an encompassing medium and different in nature from the other presentations.

The second stage of data collection process was for the author to classify each visual as one of the following: word visual, graph, diagram, map, or other.

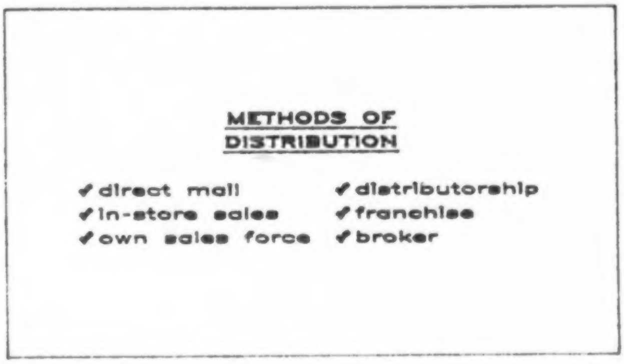
Word visuals were considered to be those which were predominately lists of words which provided textual support to the presentation. In some cases pictures or other icons accompanied these visuals, however, if the nature of the visual appeared to be primarily textual, the visual was classified as a word visual. Tables of numbers were also classified as word visuals because the table's numeric information was not used in convey position, as on a graph, but was used to show numbers as information. Some examples of word visuals are shown in Figure 1.

Figure 1
Types of Word Visuals



TYPES OF PRESENTATIONS

1. Inform
2. Persuade
3. Entertain
4. Motivate

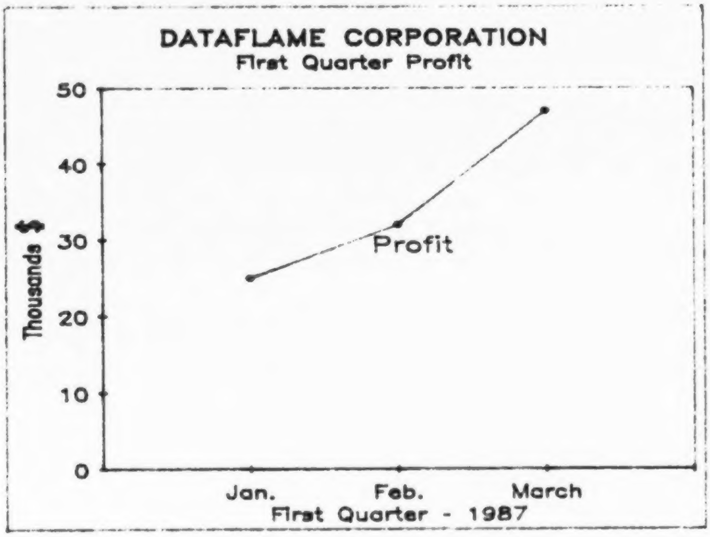


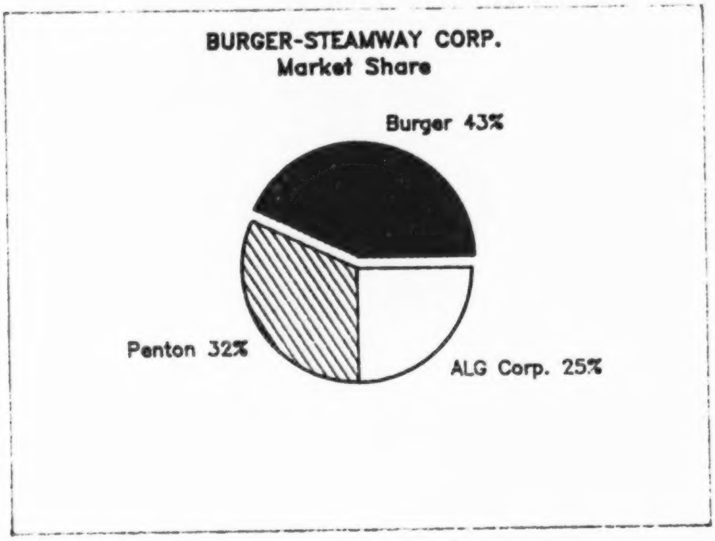
METHODS OF DISTRIBUTION

- ✓direct mail
- ✓in-store sales
- ✓own sales force
- ✓distributorship
- ✓franchise
- ✓broker

Graphs were the second category of visual. Graphs are defined as numerical arrays in picture form. They consist of line, column, bar, or pie graphs as well as a variety of special purpose graphs. Special purpose graphs were used primarily by engineers at the meeting to convey extremely technical information. Graphs were one of the easiest categories to classify because they clearly fell into their category. It is hard to confuse a graph with a word visual or diagram. Examples of several graphs are shown in Figure 2.

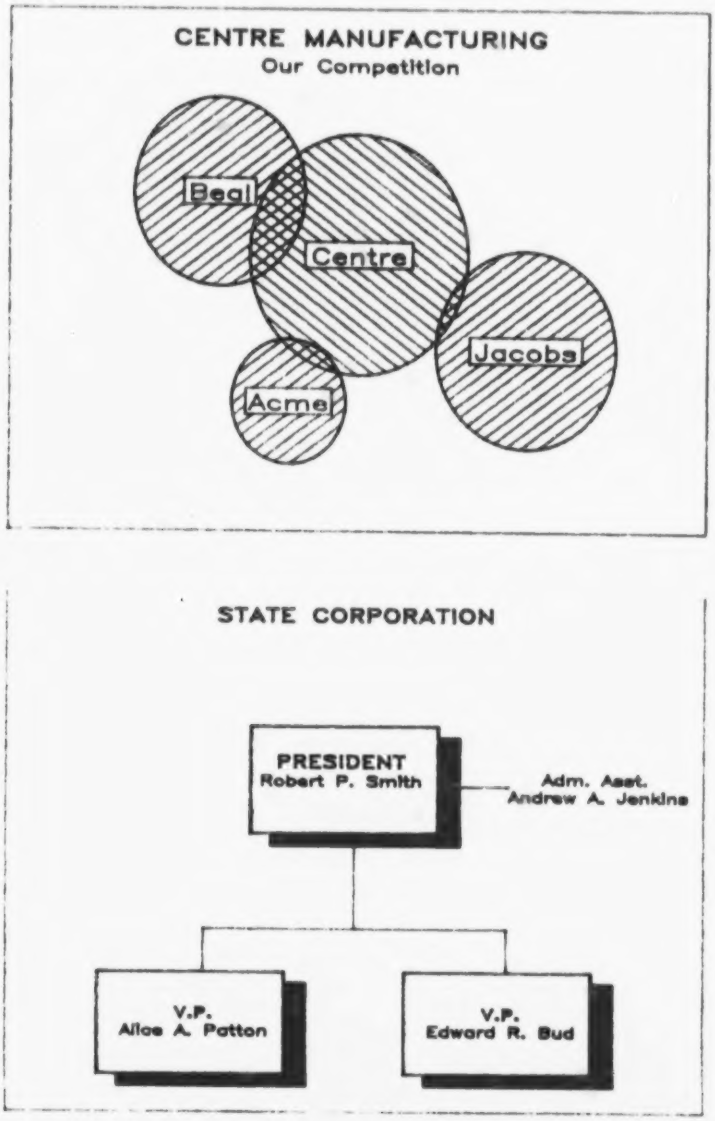
Figure 2
Types of Graphs





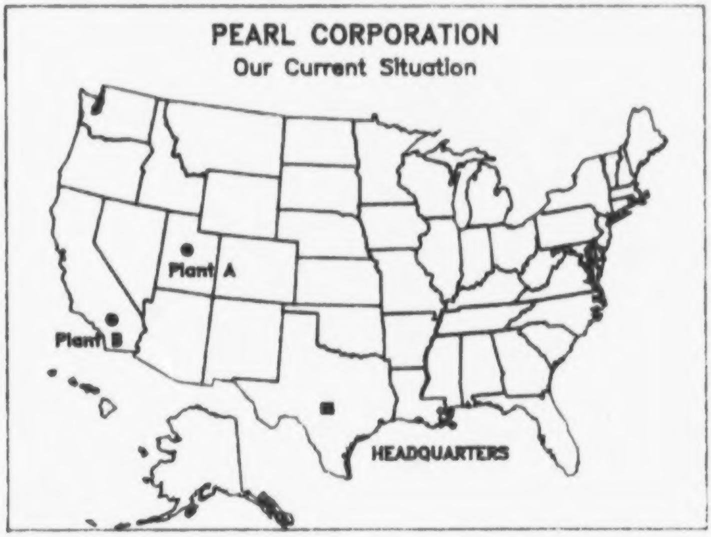
Diagrams were the most difficult form of visual to be classified. Diagrams visually represent flow, direction or procedure to be followed in the completion of a process. Diagrams, like word visuals, often contain pictures or icons which add to the artistic value of the visual, but they rarely enhance the diagrams meaning. To correctly classify visuals in this category a judgement had to be made whether the visual fit the definition of a diagram. Examples of diagrams are shown in Figure 3.

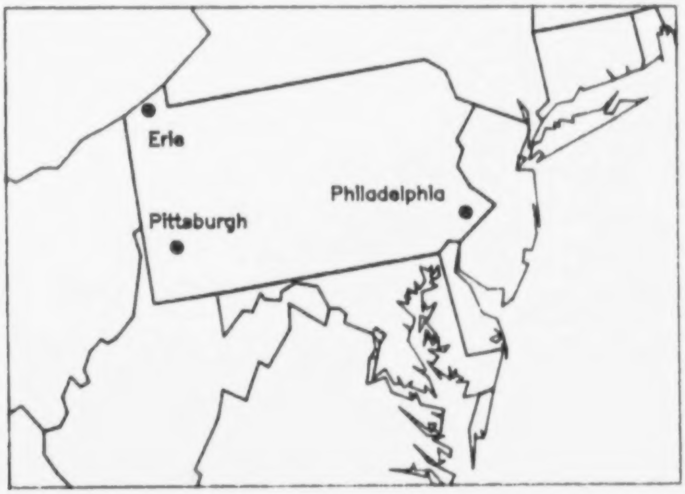
Figure 3
Types of Diagrams


CENTRE MANUFACTURING
Our Competition
Beal
Centre
Jacobs
Acme
STATE CORPORATION
PRESIDENT
Robert P. Smith
Adm. Asst.
Andrew A. Jenkins
V.P.
Alice A. Patton
V.P.
Edward R. Bud

Maps were another easy form of visual to classify. Like graphs, maps were not easily confused with any other type of visual. Maps are diagrammatic representations of geographic area. While maps represented the smallest category of visual in the study, it is interesting to note that many presentations made at the Boston meeting included maps. Maps represent a growing category of visualization because new computer graphic software is available to produce visuals in this category. Map examples are shown in Figure 4.

Figure 4
Types of Maps


PEARL CORPORATION
Our Current Situation
Plant A
Plant B
HEADQUARTERS


Erie
Philadelphia
Pittsburgh

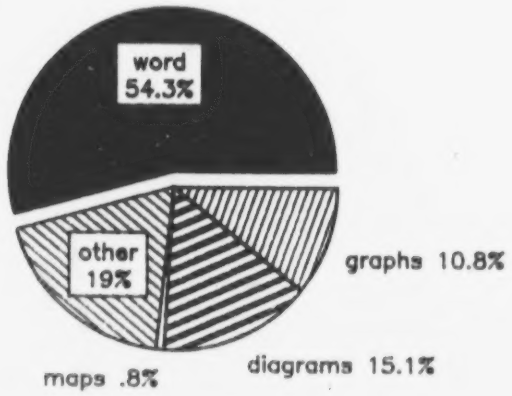
The category of "other" became the final category of classification. This category became an all inclusive category for any visual that did not fit the previous four classifications. This category included pictures of products and people, manufacturing plant locations and pictures of the products being used by consumers.

The results of the entire data collection are shown in Appendix B.

Results

When the results of the study were tabulated and analyzed, it was found that word visuals were the largest single category of visualization. On average, word visuals account for 54.3% of the visuals used in a message. Word visuals outnumber any other form of visualization by more than two to one. The results of this portion of the study are shown in Figure 5.

Figure 5
Types of Visuals Used:
All Media



A recent study concerning what media are used most frequently by business people were conducted by PC MAGAZINE[1]. This data shows overhead transparencies are the dominant projected medium for business. Based on this study, if we take a closer look at the presentations made just with overhead transparencies, we see an even greater use of word visuals. In this case, word visuals are used 62.8% of the time. The results from those presentations using only overhead transparencies are shown in Figure 6 and in table form in Appendix C.

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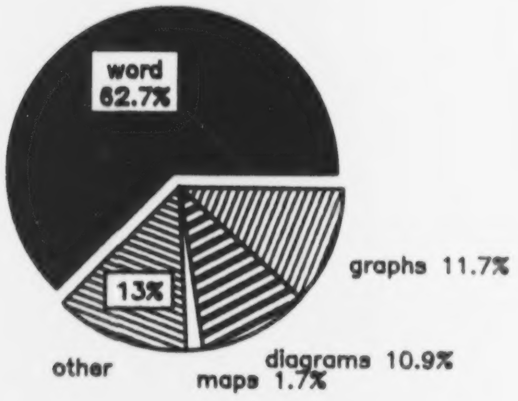
[1] PC MAGAZINE, Achieving the Proper Image, Volume 7, Number 16, September 27, 1988.

Figure 6.
Types of Visuals Used:
Overhead Transparencies



Implications

The implications of the study are clear. Word visuals dominate business presentations. These visuals are not the iconic or diagrammatic type of visual that help an audience reach higher levels of comprehension about a message. The word visuals seen in this study appear to serve a single purpose. They were used when the presenter wanted to share an outline of the presentation with the audience. This process is similar to creating a written outline of a presentation for distribution except in this case the outline is in the form of 2x2 slides or overhead transparencies.

In every case the presenters included far more outline than any audience could adequately comprehend. Griffin[2] indicates the maximum suggested amount of information that is recommended for word visuals. Unfortunately every word visual observed for this study exceeded the recommendations suggested in this citation. Presenters observed in this study generally overused word visuals.

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[2] Griffin, R.E. (1988) A visual Primer: The Manager's Guide to Preparing a Visual Presentation, Manuscript submitted for Publication, p. 88.

Why do we over use so many word visuals? Presenters appear to use them as note cards or cue cards to prompt them on what next to say in a presentation. Word visuals, used in this excessive manner, can always be present to prompt a presenter for his next spoken word. Some oral communication experts advocate this technique as a rationalization for using visuals in a presentation. These experts tell presenters that having these visual cue cards is just another good reason for using visuals. While the strategy of cue card visuals may make sense from the presenters point of view, there is strong evidence that this technique severely overloads the visual portion of the message and provides dissonance in the message. Most listeners can not comprehend visually overloaded messages just like they can not understand messages that are overloaded with spoken information.

Presenters appear to overuse the technique of word visuals and clog the visual communication channel with excessive information. How many word visuals appear to be enough in a presentation? While this subject needs to be thoroughly studied beyond this report, this author suggests that we reduce the number of four or five well chosen word visuals in a thirty minute presentation which uses twenty visuals. This is a much more manageable number of word visuals. While this study found the average presentation uses eleven word visuals, the recommended four visuals will much better serve the purpose of visual communication.

The recommendation suggests that we appear to use an adequate number of graphs, diagrams, maps and other visuals to make our communication clear. Word visuals, and particularly the overuse of word visuals, appear to be the culprit. The above guidelines do not eliminate visuals in any category, except word visuals. The guideline cuts the number of word visuals by over 50%. What do you do with the remaining time? Particularly in the overhead transparency presentations, you do nothing. You gain communication clarity by allowing the audience to listen to you without visual distractions. In short, do not add new visuals to fill the void...turn the projector off and use good oral communication skills. You do not need a constant flow of visual images.

Conclusions

Visuals designers must be aware of their importance in helping others design effective messages. They should concentrate their efforts on word visuals and their visual design skills must be researched, written about and shared with the communicating public. Skills in visual message design continue to become increasingly important in today's business environment.

APPENDIX A
PRESENTATIONS STUDY

- A New Thermal Transfer Ink Sheet for Continuous Tone Full Color Printer
- Business TV: A User's Viewpoint
- Computer Generated Business Graphics -- A Business Tool
- Design for a Color Commercial Video Printer
- Desktop Image Processing -- 1988
- Education and Video Networks -- Futures and Dependencies
- Electronic Fonts
- Electronic Photography: The profit Picture Needs Enhancement
- High Speed Scanners and Document Management Applications
- Imaging in the Future Workstation
- Inks and paper for Ink Jet Printing
- Is the Issue Growth Rates or Mass?
- Key Elements & Interactions of Ion Printing
- Large Screen Color AC Plasma Display
- Monochrome and Color Amorphous Silicon PIN Diode Active Matrix LCD for Military Applications
- New Horizons for Ink Jet
- Next Generation Office Workstations
- PC Based Color Graphics Printing: New Advances in Thermal Ink Jet Technology
- Polaroid Laser Print Service -- Electronic Imaging: Consumer Acceptance
- Resolving the Resolution Issue in Records Management Displays
- Satellite Network Programming on ETV for Souther Baptist Churches
- Scanner Selection: More Important Than You Think
- Second Generation Resistive Ribbon Technology in Quietwriter III Printers
- Single Pass Color Electrostatic Systems Promote Productivity
- Speed and Flexibility with Ion Printing
- Thermal Dye Transfer: Media Design Considerations
- Thermal Dye Transfers Products and Applications
- Thermal Printing: Rapidly Changing Technology
- Thermal Transfer Imaging -- Today and Tomorrow
- Very High Resolution Displays for Imaging Applications
- Xerox Advances in Electronic Printers

APPENDIX B
DATA ON VISUAL STYLE AND VISUAL CLASSIFICATION

Presentation #	Type	Word Visuals	Graphs	Diagrams	Map	Other	Total
1	slide	2	2	4	0	0	8
2	no visuals used in presentation						0
3	overhead	10	0	2	0	1	13
4	overhead	14	2	2	0	1	19
5	overhead	11	1	4	2	1	19
6	slide	11	3	2	0	8	24
7	slide	21	4	4	0	16	35
8	overhead	14	0	0	0	0	14
9	overhead	8	7	1	1	0	17
10	slide	17	0	3	0	9	29
11	overhead	15	4	2	1	5	27
12	overhead	12	3	1	0	2	18
13	overhead	6	1	1	0	3	11
14	overhead	10	2	4	0	4	20
15	slide	7	1	1	0	0	9
16	overhead	12	2	4	0	5	23
17	slide	7	7	2	0	2	18
18	slide	5	8	7	1	9	30
19	slide	10	3	5	0	6	24
20	slide	7	6	5	0	3	21
21	slide	8	0	9	0	0	17
22	overhead	12	1	1	0	0	14
23	slide	14	1	14	0	11	40
24	overhead	11	0	2	0	8	21
25	overhead	15	5	2	0	1	23
26	slide	33	2	3	0	20	58
27	slide	23	1	4	0	1	29
28	slide	15	0	1	0	0	16
29	no visuals used in presentation						0
30	slide	8	1	4	0	0	13
31	no visuals used in presentation						0
		338	67	94	5	118	610

APPENDIX C
DATA ON OVERHEAD TRANSPARENCY ONLY PRESENTATIONS

Presentation #	Type	Word Visuals	Graphs	Diagrams	Map	Other	Total
3	overhead	10	0	2	0	1	13
4	overhead	14	2	2	0	1	19
5	overhead	11	1	4	2	1	19
8	overhead	14	0	0	0	0	14
9	overhead	8	7	1	1	0	17
11	overhead	15	4	2	1	5	27
12	overhead	12	3	1	0	2	18
13	overhead	6	1	1	0	3	11
14	overhead	10	2	4	0	4	20
16	overhead	12	2	4	0	5	23
22	overhead	12	1	1	0	0	14
24	overhead	11	0	2	0	8	21
25	overhead	15	5	2	0	1	23
		150	28	26	4	31	239

Using Graphs Correctly: What Are the Basic Elements for the Language of Graphs

Robert E. Griffin
Penn State University

You have been asked to speak at the next financial officer's meeting. To prepare, you have developed a draft outline of your presentation and have begun thinking about ideas for 2x2" slides. These ideas include several graphs and tables of data that will explain your point of view. Now you must convert your ideas to reality.

Your next step is to determine how to produce the visuals that will eventually become 2x2" slides. You could turn to conventional means and have the visuals created by your company's art department or a free lance artist. Today, however, a more likely decision is to design the visuals yourself on your personal computer's color cathode ray tube using one of the many graphic software packages available. The resulting graphic can either be photographed from the computer screen or drawn on a graphics plotter, printer, or film recorder. The personal computer, loaded with one of the many available computer graphics programs, gives the computer operator the freedom and many of the tools that were once only the province of the graphic artist. With computer graphics software and an output device, almost anyone can create 2x2" slides & overhead transparencies.

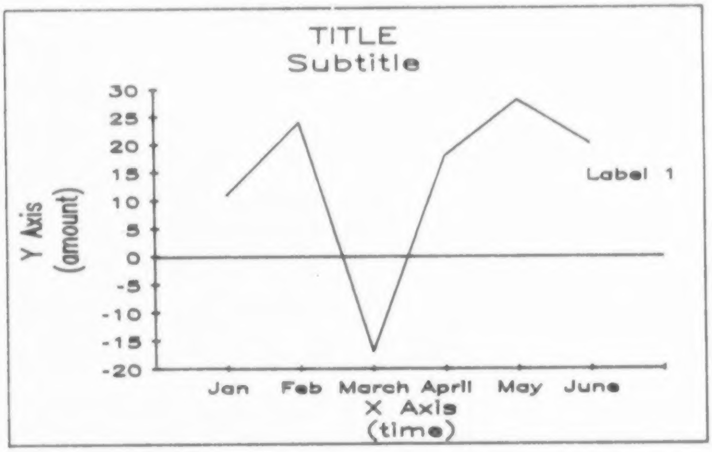
Of course with this new artistic freedom come problems. While the computer's power grants the computer operator a great many of the artist's tools, tools alone are not enough to create good presentation graphics. To properly use computer graphic programs the operator must impose graphic design rules on the computer and the software. Without a firm understanding of the graphic design rules, your resulting graphics software may not meet your presentation needs. This paper will describe the basic rules of graph design and then describe the graph types which are appropriate to use to convey various kinds of information.

The designer of business presentations must know the basic concepts of graph design.

The Basics of Graph Design

For a graph to be clear to an audience, particularly in an oral presentation where the graph is before the audience for only a brief moment, the graph must instantly communicate its message to the audience. Consider this situation: a graph is projected on a screen for only 15 seconds in the typical presentation. It is obvious that the purpose of the graph must be clear, the message simple, and the data legible. These are very rigid requirements to place on a device as seemingly simple as a graph. Graph construction is not as simple as it may seem. What are the basic building blocks of a graph? Refer to Figure 5-1 as the following specific items of graph design are described.

Figure 5-1
THE BASIC GRAPH



(1) Title

The first requirement of a good graph is that it should have a title. The title is usually placed at the top center of the graph. The purpose of the title is to tell the audience what they are about to look at before their eyes get involved in the complicated data below. The title serves as a constant reminder to the audience of the graph's purpose. If it is possible the title should answer for the audience the questions; who, what, where, when, how, and why. It may not always be possible to answer all of these questions in a title, but an attempt should be made to provide this information. In general, one or two line titles are all that is required. The main title should be written in all capitals or in upper and lower case, with bold letters. The subtitle should be written in a smaller size letter in the same style as the main title. Titles should be larger than all other printing in the graph.

(2) Vertical Axis (Y-Axis)

Every graph (with the exception of the pie chart and a few other special purpose graphs) is constructed from the intersection of a horizontal and a vertical line called the axis lines. The vertical line, referred to as the Y axis, is normally designated to carry the dependent variable or amount. Above the point of the intersection of the Y axis with the horizontal axis, the amounts shown on the Y axis have positive values. The area below the intersection of the horizontal line is for amounts with negative values. When the graph does not contain negative values, the portion of vertical line descending below the horizontal axis is not shown on the graph.

Calibration of the vertical axis should begin with a "0" at the point where the vertical axis intersects the horizontal axis. Amount numbers should begin from this point and increase in value (or decrease in value if you are labeling the negative scale) until the maximum value is reached. Scales in the vertical axis should only be as high as necessary to graph the largest value in the data array. For example, if the highest number in your data array is $95.00, that number or $100.00 should be the final value on your vertical axis.

Scale calibration lettering or numbering on both the vertical and horizontal axis is the smallest lettering to appear on the graph, however, remember to make this lettering legible for the intended audience. Oftentimes this lettering is allowed to be too small and cannot easily be interpreted.

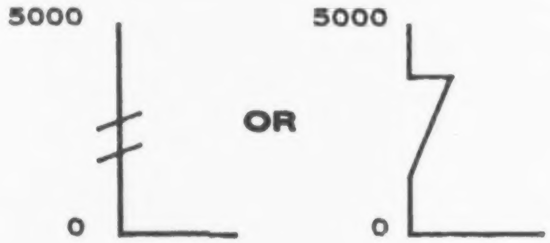
3) Horizontal Axis (X-Axis)

The horizontal axis, called the X axis, is normally used to designate the independent variable or time. Time can be designated as years, quarters, hours, or any other easily recognized amount. The horizontal axis should be labeled with the oldest period of time at the extreme left and the most recent (or projected) time to the right. Scaling of the horizontal axis should only include those periods necessary to describe the message of the graph.

As with the vertical axis, scale calibration lettering or numbering on the horizontal axis is the smallest lettering to appear on the graph. (Remember my cautions about legibility.)

If either the vertical or horizontal axis must be broken, and contiguous data omitted, the axis should be marked with either of the symbols shown in Figure 5-2.

Figure 5-2
BREAKING THE AXIS



These symbols are commonly used to identify an alteration in the data and to indicate to the audience that they should pay particular attention to this change.

(4) Tic Marks

Tic marks should be placed on the axis lines to denote amounts and should appear directly by the appropriate data point. Tic marks can be left unlabeled if their designation is apparent. However, be sure to provide enough information to make their designation instantly clear to the audience. As a general rule, try to label tic marks at 5, 10 or 25 number intervals.

It is not a good idea to connect the tic marks on the horizontal and vertical axis to provide a grid in the body of the graph. Likewise, it is not a good idea to plot graphs that you will use for a presentation on graph paper. The grid background, while making it easy to identify specific values of lines, columns or bars, oftentimes makes the graph overly complex for the audience. Grid patterns should be used only for graphs that will be closely scrutinized by the audience.

(5) Axis Labels

Axis labels are another important item on a graph. All labels should be done in a combination of upper and lower case letters in a size smaller than the titles, although larger than the axis calibration scales. Where possible the axis labels should be horizontal so that they can easily be read. It is oftentimes impossible or impractical to have the vertical axis label written on the horizontal because of the inordinate space a horizontal label would consume. For this reason, it is appropriate to write the primary vertical axis label vertically beginning at the bottom of the graph and writing to the top. Numerical values, used to calibrate the axis, should be written horizontally since the audience member will need easy recognition of these values as he looks at the chart.

Identify Elements Within the Graph

The audience must know the designations for your lines, columns, pie slices or bars. This is usually accomplished with a legend or key. These devices, however, have their faults. The audience must first glance at the key and then glance back to the body of the chart. This eye movement pattern is repeated many times as the audience views the chart. This eye movement distraction can be a major problem for a graph used in an oral presentation. The audience must be given time to relate the key to the body of the graph in an oral presentation. For this reason, it is best to label the various lines within the body of the chart and eliminate the use of a key. The closer the identifying description can be to the main body of the graph, the easier it will be to understand. Likewise, if it is necessary to have the audience know the specific value of particular columns in a column chart, then those values should be placed directly above the column. Labeling close to the intended subject will aid in making your charts instantly understandable to the audience.

Legends or keys are acceptable when it is necessary to avoid clutter within the body of the graph.

Simplicity of Information

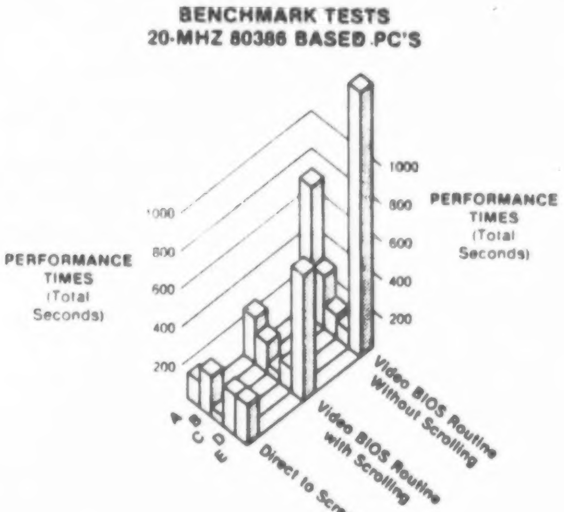
One final basic rule needs to be mentioned. To make graphs instantly understood by the intended audience they must be kept simple. Let's consider some basic elements of simplicity.

As a general rule, a graph should show no more than five different items of data. For example, in a line chart it is confusing to see more than five lines meandering through the body of a graph, this can easily confuse an audience. Pie graphs also become hard to read when they have more than five slices.

Line patterns and color on a graph should be used to differentiate discreet items from one another. In a multiple line chart, for example, different lines should be depicted by a different line type and, when possible, a different color. Particularly when these visuals are used in an oral presentation, multiple methods of visual discrimination are helpful.

A comment also needs to be made regarding the current vogue of 3-D or three dimensional graphs. On those occasions when it is necessary to produce a graph on three dimensions, it is necessary to plot the graph on the vertical, horizontal and depth axis. This triple axis plotting gives the graph an extra dimension for additional information. This effect is shown in Figure 5-3.

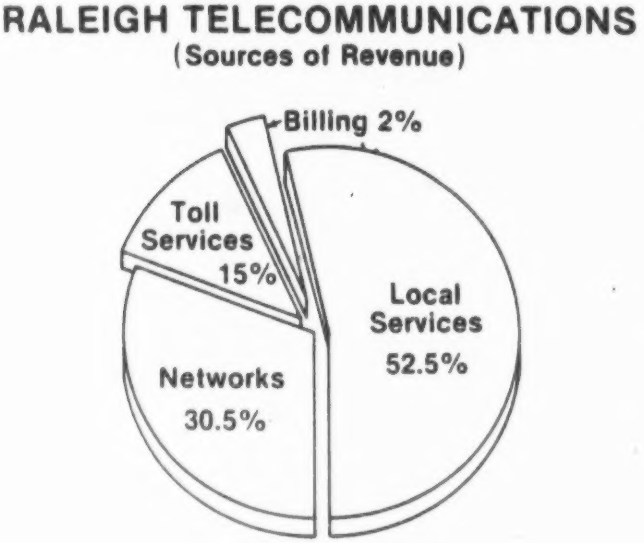
Figure 5-3
A 3-D GRAPH
WHERE THE 3rd DIMENSION GRAPH ADDS INFORMATION



Unfortunately, three dimensional graphs are being overused today.

In most cases the 3-D graph is not being used to show data on a third dimension, but is being used to add an "artistic" effect to the graph. Many popular business graphics computer software programs now provide a 3-D option to their graphing capabilities. Three dimensions are being applied particularly to column graphs and pie graphs. Unfortunately, 3-D as used in these instances, does not help the audience more easily understand the graph. In some cases 3-D hinders interpretation of the graph. An example of the ineffective use of a 3-D pie graph is shown in Figure 5-4. What is the value of the depth to the pie slices?

Figure 5-4
A 3-D GRAPH WHERE THE THIRD DIMENSION HINDERS INTERPRETATION



I believe the added depth adds nothing to the pie graph and may actually confuse the graph. Three dimensional graphs, when improperly used, add confusion to a method of presentation which is designed to simplify understanding.

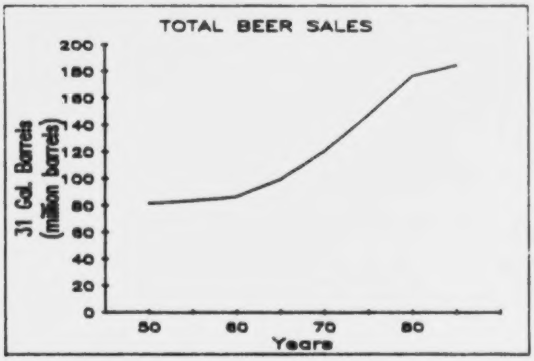
What Graph Type to Use

Now that you have a general idea of how to prepare graphs, let us determine which type of graph to use. Graph types can be divided into four major styles: line graphs, column graphs, pie graphs and bar graphs. There is a fifth very broad category referred to as "other" which will not be discussed here. This fifth category of graphs covers the many special purpose graphs (i.e. high/low/close graphs, log-log graphs, etc.) that are available.

Line Graph

The basic line graph follows all of the basic rules of graph design outlined in the first part of this paper.

Figure 5-5
BASIC LINE GRAPH

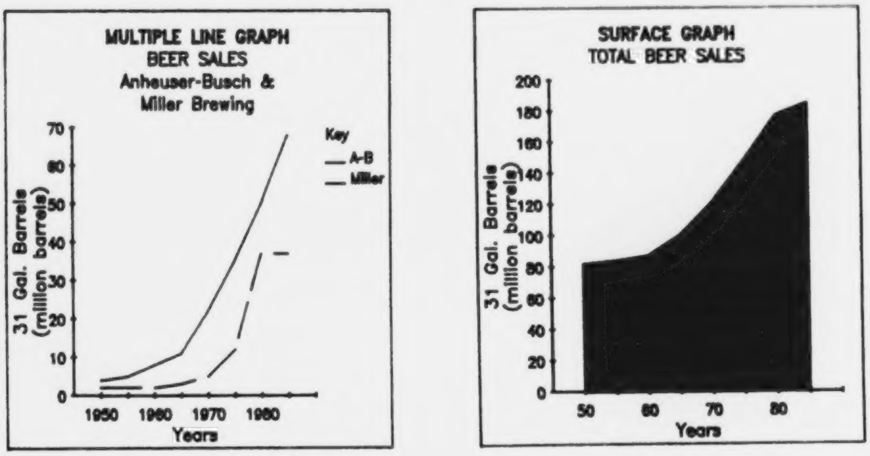


A line graph is to be used in one or more of the following circumstances:

1. when the data you want to depict covers a long period of time
2. when several time series or trend observations are to be compared
3. when the emphasis of the data is to be placed on trends, estimates or interpolations

Major subforms of the basic line chart are shown in Figure 5-6. The multiple line graph is used as you would use a simple line chart except that the multiple line graph is used to display two or more variables or sets of data. The surface graph is used when you want to depict any of the above mentioned qualities of the line chart, plus emphasize the dimension of quantity by shading the area below the trend line.

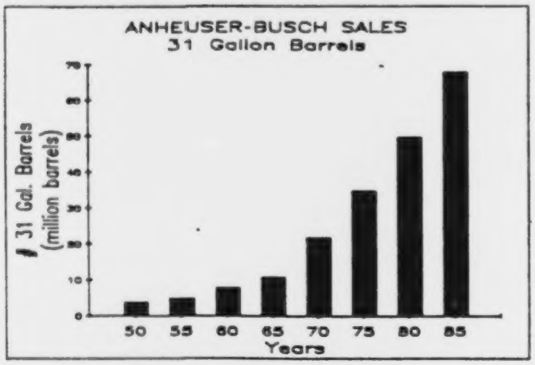
Figure 5-6
SUBFORMS OF THE LINE GRAPH



Column Graph

The second major graph type, the column graph, also follows all of the basic graph design rules.

Figure 5-7
BASIC COLUMN CHART



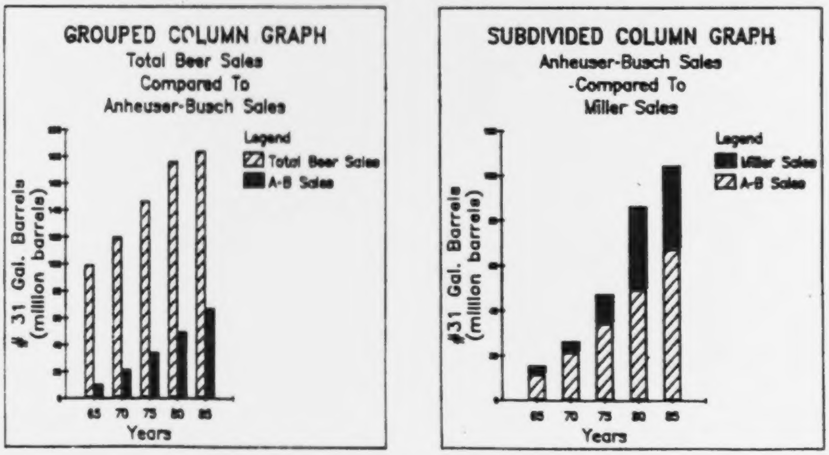
A column graph is used in one of the following circumstances:

1. when you want to compare or contrast specific amounts between one period and the next
2. when you want to emphasize the amount of data in a series of data rather than emphasizing a trend

Major subforms of the basic column graph are shown in Figure 5-8. The grouped column graph is used to compare or contrast multiple amounts over the same time period. In the grouped column graphs it is an easy matter to compare one column to any of the others in the graph.

The subdivided column chart is used to depict the categories that make up the total amount. The emphasis on a subdivided column graph is placed on total amount rather than a comparison of individual amounts.

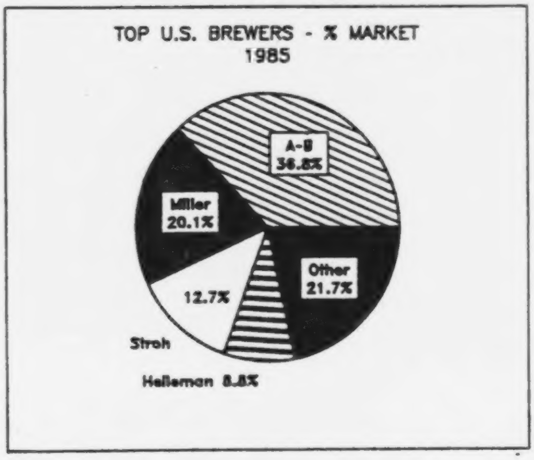
Figure 5-8
SUBFORMS OF THE COLUMN GRAPH



Pie Graph

The third major type of graph is the pie graph. The pie graph is a radical departure from the two previous graph types. Since the X and Y axis no longer exist, it should be obvious that this graph style serves several unique purposes.

Figure 5-9
BASIC PIE CHART



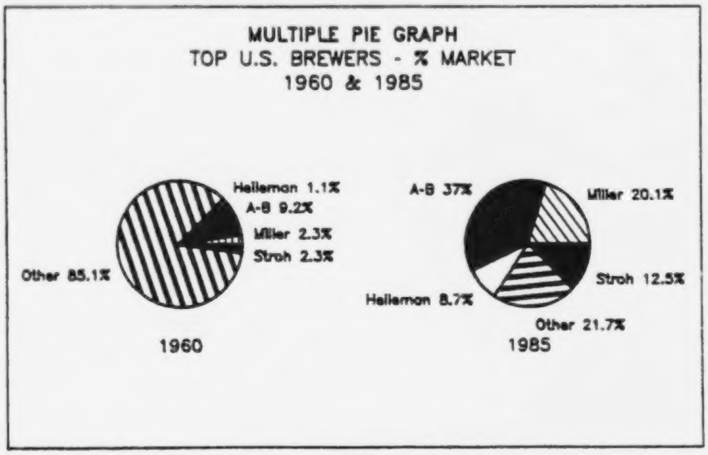
It is wise to limit slices or divisions in your pie graphs. Most experts limit pie charts to no more than five divisions.

A pie chart is used when:

1. you want to depict portions of a whole
2. you want to depict percentage portions of 100 percent

Major subforms of the pie graph are limited. The only subform of pie graphs is using multiple pie graphs such as those shown in Figure 5-10.

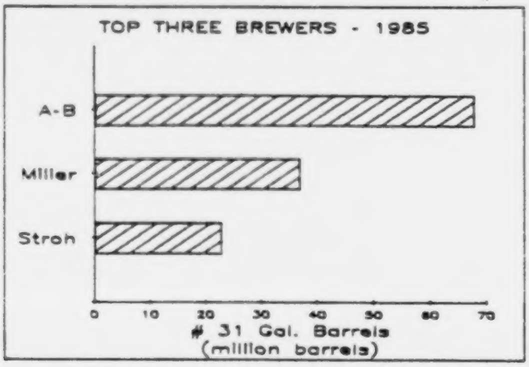
Figure 5-10
SUBFORM OF THE PIE CHART



Bar Graph

The final type of graph is the bar graph. Do not assume that a bar graph is simply a column chart on its side. Bar graphs differ from line and column graphs in that they portray only one axis or scale. This single scale is an amount scale and is shown horizontally on the graph. The vertical axis on a bar graph is used to list the items that are being depicted.

Figure 5-11
BASIC BAR CHART

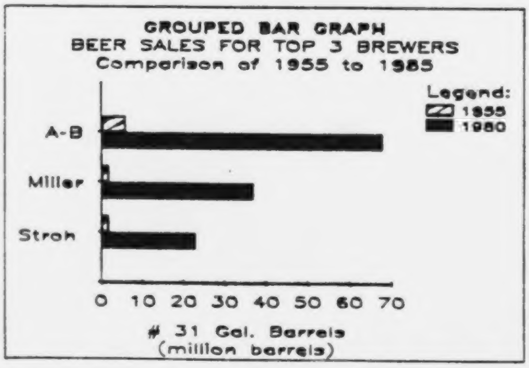


The bar graph is used when you must alter any or both of the axis purposes. If you must show some data that does not fit the more common y axis = amount/x axis = time labeling, then you should select the bar graph and proceed to alter the labels of the axis. A bar graph is used in one of the following circumstances:

1. when the axis labels are to be altered from normal time/amount labels
2. when separate items are to be compared to one variable

The major subform of the bar graph is shown in Figure 5-12. The grouped bar graph is similar in purpose to the grouped column graph.

Figure 5-12
SUBFORMS OF BAR CHART



We have explored the fundamentals of graph design and then discussed the various types of graphs and how those graphs are to be used. On the surface graphs seem to be one of the simplest communication devices. They consist of two intersecting lines, some simple labels, and a potpourri of colored and patterned lines. This paper has attempted to impress upon you how simple graphs can be to create. But, the computer designer must understand the basics of graph design and be able to determine which graph type is the most appropriate to convey the desired information. The computer user is going to have to absorb these rules if he is to successfully communicate graphic data with others.

A Formative Evaluation Study: Development of a Visual Thinking Handbook for Adult Learners

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INTRODUCTION

The author has recently completed the development and formative evaluation of an instructional product titled How To Use Simple Graphic Tools for Thinking, Planning, and Problem Solving. The purpose of the study was to develop a handbook for adults which shows how to use simple geometric shapes to express visually the structure of ideas, thoughts, plans, etc., thus contributing to visual literacy. The perspective taken in the handbook provides a holistic, synthesizing approach to problem solving and to thinking in systematic ways about the world. The resultant graphics might serve as a basis for communicating thoughts and ideas to others

CONTEXT

Thinking and solving problems that relied on solutions from the past were satisfactory in a stable, predictable environment. However, the age we live in is increasingly turbulent and complex, bringing unpredictable change that impacts at individual, group, community, national, and international levels. Antiquated approaches that worked well in simpler times no longer solve pressing social problems. The reason is that present-day problems are not being adequately defined in all their complexity.

A mere glance at publications from newspapers to journals to texts, and at film and other media, tells us that the visual mode of communication will continue to be primary in our culture. We see, yet many do so with little comprehension or skill, with very little "literacy."

In Tools for Change (1977), C. H. Waddington promotes the use of illustrations of ideas and concepts as graphic change tools to help the imagination grasp the gist of an idea and help the mind think clearly about complex social systems and how they are interconnected. He concludes that with so many things going wrong we must be thinking in wrong ways about how the world works. Perhaps those ways of thinking might be wrong because they are exclusively linear, sequential, verbal ways and lack visual, simultaneous perspectives.

T. Harrell Allen (1978), a policy sciences and futures researcher, concurs with Waddington and presents a similar argument for dealing with today's complex social problems. He urges that a holistic perspective and a graphic language be employed to provide an overall picture of a problem or issue. He claims a complex problem has two aspects, structure and content, and failure to communicate the structural aspect contributes to communication impasses and results in inadequate, incomplete solutions.

We live in an age of increasing complexity where real-world problems are composed of many elements whose relationships are often obscure and unclear, which makes them difficult to comprehend. Often problems that appear separate from one another are, in fact, related, but the relationship is not discovered until solutions that subsequently are found to be contradictory.have been put into place Problems are not being explored adequately, beyond content, in order to identify their structure and contexts, and therefore, relationship. As both Waddington (1977) and Allen (1978) state, the "big picture" must be constantly considered.

McLuhan (in Sless, 1978) raised the question of the influence of media on the kind of thinking that takes place and said that the "linear and sequential nature of the written word encourages linear and sequential thinking" (pp. 87-88). Without special educational efforts, opportunities to perceive, conceptualize, and think about problems as wholes are diminished and chances for finding comprehensive solutions decreased.

Waddington promotes illustrations of ideas and Allen suggests doing what artists and designers do routinely in their professions: combine graphics with words in the problem-defining and problem-solving process. Visual artists and designers see problems as wholes and move smoothly from concrete to abstract and vice versa. Visual approaches to thinking and to problem solving do not occur in the humanities and sciences as often as they might. Ideas presented by some scholars might be received better with a visual illustration or two, and enable the reader to grasp the writer's thoughts more surely.

As problem solvers, we lack the ability to perceive and convey ideas, social issues and problems adequately, to think about them visually, and to conceive of and express graphically their structure and wholeness. We tend to focus on a problem in isolation and neglect to see it in its setting or in relation to other problems.

Graphic approaches to problem solving in fields outside of the arts have been shown to be productive in planning, small group work, and generally in the exploration of ideas: Diagram: The Instrument of Thought by Albarn and Smith (1977), Using Graphics With Groups by Geoffrey Ball (1979), The RSVP Cycle by Lawrence Halprin (1969), A Handbook for Visual Problem Solving by Gordon Lippitt (1976), Experiences in Visual Thinking (1972) and Thinking Visually (1980) by Robert McKim, Design Thinking by Peter Rowe (1987), Guide to Group Graphics by David Sibbet (1983), and Summary of Basic Concepts-Tools for Change by David Straus (1972).

NEED

The need for enhanced visual thinking to counter dominant linear, sequential thinking modes and bring about balance is apparent. Usually descriptions of social problems are limited to words and an occasional chart or diagram. Yet social problems can be described visually. Social scientists and others tread verbal-only, we've-always-done-it-this-way paths. Yet hey may carry in their heads mental images of the complex issues they study, not appreciating that these images are assets to be shared. Scholars and scientists can learn to integrate visual thinking into traditional verbal thinking so that they can fully define problems and their structures.

New perspectives on problems and techniques to deal with pressing social, professional, and personal problems are needed. Few instructional products have been developed that set out to show people how to think visually using easily-learned techniques and simple graphic shapes to represent ideas and problems, not as artists but as problem definers and solution seekers. The product developed in this study is a handbook of text, examples, and opportunities to practice using the shapes to represent problems and ideas in ways that make structure and relation visible and to place problem elements within a context.

HISTORICAL FOUNDATIONS

The foundations of the study are found in the way images and thinking were perceived in the past, in cognitive and *gestalt* psychology, in visual thinking and visual literacy, in visualization and externalization of images, and in approaches by those from other disciplines who explored similar ideas. Historically, the foundation for thinking visually goes back to Aristotle who believed that some thought was composed of images, and to Locke, a seventeenth century philosopher, who also believed that thought was composed of images that originated in perceptions (Samuels & Samuels, 1975, p. 34). Aristotle attributed a vital role to mental images and claimed that "thought is impossible without an image" and "memory, even the memory of concepts, does not take place without an image" (Kosslyn, 1983, p. 5).

Cognitive and *gestalt* psychology provide additional bases from which to investigate visual thinking. Neisser (1967) has written extensively on cognition, which he said refers to all processes "by which the sensory input is transformed, reduced, elaborated, stored, recovered, and used...even when [these processes] operate in the absence of relevant stimulation, as in images", and he identified sensation, perception, imagery, retention, recall, problem solving, and thinking as referring to aspects of cognition (p. 4). Arnheim (1969) contends that perception is cognition (p. 13) and that visual perception is visual thinking (p. 14). By cognition he means "all mental operations involved in the receiving, storing and processing of information: sensory perception, memory, thinking, learning." (p. 13).

Gestalt psychology also is concerned with perception and thinking, and the German psychologists Kohler, Wertheimer, Koffka, studied perception phenomena experimentally. From experiments, Wertheimer formulated principles of organization that identified the way *Gestalten* are organized:

- The differentiation of figure and ground is the major principle.
- The principle of proximity states that objects close together are perceived together.
- The principle of similarity states that objects of the same color or shape are perceived as a group or as a separate group if objects are of a different color or shape.
- The principle of closure is the tendency to fill in gaps to complete a figure.

Wertheimer carried his interest in thinking further in Productive Thinking (1959), terms which refer to the grasp of structure -- the *gestalt* -- of a problem or situation and serve to interrelate problem, activities, and context. Taken together, these enable part-whole relationships to be perceived. His approach to productive thinking incorporated the use of geometric figures.

VISUAL THINKING

Everyone engages in visual thinking at some time: map reading, playing board games (chess is a totally non-verbal example), recalling a familiar face, classifying collections (rocks, stamps, coins, etc.), viewing diagrams, observing traffic flow, etc. Visual thinking occurs directly from visual perception, from concrete recognition of external events and objects. Perceiving an object is becoming aware of its properties, and having such knowledge is perceptual thinking. A number of theorists, educators, writers and others have studied visual thinking (Arnheim, [in Kepes, 1965], 1968, 1969; Fork and Jonassen, 1976; Gueulette, 1987; Hortin, 1980a, 1980b, 1982a, 1982b, 1984; John-Steiner, 1985; McKim, 1972, 1980; Paivio, 1978; Samples, 1976).

Arnheim's work (1968, 1969) on visual thinking provided the capstone for this study. Many of his conclusions were based on empirical studies in education, physiology, psychology, and perception that he carried out and that were carried out by others (Asch, Bruner, Cassirer, Deutch, William James, Koffka, Kohler, Montessori, Neisser, Penfield, Piaget, Wertheimer, etc., in Arnheim, 1968).

Arnheim's study (1968) and his seminal publication, Visual Thinking (1969), are significant for a number of reasons, one of which is that perception is the dominant and legitimate source of knowledge of the external world. Visual thinking is a thinking operation and in the very process of perception, concepts take shape. He said "words are but labels, and there can be no labeling before the senses have furnished defined kinds of things" (Arnheim, 1965, p. 6).

Fork and Jonassen (1975) are also concerned with visual thinking and wrote that "Visual thinking depends upon visual perception sequentially combined with the formation of cognitive structures into a continuous process" (p. 1). Gueulette (1987) refers to Hortin who says visual thinking involves seeing the external world, making a visual representation of that and exercising mental imagery from which we create mental images in order to organize, simplify, and interpret our experiences (pp. 205-219).

VISUAL LITERACY

The growth of interest in visual literacy reflects continuous presence of visuals and graphics and their expanding use in all media. Technology has made this possible. Also, our information society requires greater efficiency in communicating more information to more people. Presentations made at the annual International Visual Literacy Association conferences indicate clearly the scope of visual literacy and its interdisciplinary nature. Hortin (in Schiller, 1987) defined visual literacy concisely: Visual literacy is the ability to understand the use of images, including the ability to think, learn and express oneself in terms of images (p. 267). Many others have studied and written about visual literacy (Braden, 1983; Debes, 1969, 1978; Dwyer, 1978; Fork and Jonassen, 1976; Griffin and Whiteside, 1984; Hardin, 1983; Hortin, 1980, 1983; Hutton, 1978; Jonassen and Fork, 1975; Levie, 1978; Majure, 1976; Platt, 1975; Schiller, 1976; Sless, 1981; Wileman, 1980; Williams, 1978).

Griffin and Whiteside (1984) analyzed visual literature and identified three overlapping categories: theoretical, visual language, and presentational (pp. 70-82). The theoretical framework for visual literacy has come from research literature in the areas of philosophy, psychology, and physiology and includes studies of mental imagery, cognitive styles, hemispheric processes and eye movements. Visual language focuses on the student-learner and is related to teaching students to become visually literate so they can "think and learn in terms of images...to think visually" and have a survival skill necessary in a predominantly visual culture (O'Rourke, 1981, p. 73). Presentational literature, the third category, refers to the initiator, sender, or presenter in the communication process and is significant because visuals are attaining a primary role in communicating ideas and information.

VISUALIZATION and EXTERNALIZATION

Visualization and externalization are two process vital to the development of visual thinking. Visualizing is the process of imaging, mentally imagining (with or without memory involvement), visioning pictures, shapes, ideas, notions, etc. Externalizing is "causing one's internal visual images to be made externally visible, available for another's perceiving" (Majure, 1976, p. 16). Imagery and visualization have been studied extensively (Anderson, 1978; Kaufmann, 1978, 1979; Kosslyn, 1980, 1983; Levie, 1978; Paivio, 1971; Shepard, in Randhawa and Coffman, Eds., 1978), while externalization has not been paid adequate attention (Majure, 1976, pp. 16-17).

Definitions of visualization are found in two categories: Those indicating it is an internal, mental process, and those indicating it is more than an internal mental process and may include activities for externalization (Majure, 1976; McKim, 1972, 1980; Shepard [in Randhawa and Coffman, 1978]). A clear separation between the two concepts seems unlikely and in fact may not be desirable since these concepts are dynamic, interrelated, and integral to visual thinking. Hortin (in Gueulette, 1987) believes visualization is synonymous with mental imagery and says that "visual thinking involves...using the inner eye or exercising mental imagery" (p. 212). According to McKim (1972), seeing or perceiving comes before visualization or imagery in time and is followed by externalizing or drawing. McKim refers to visualization as "an inner event visible only to the mind's eye" and he sees visual thinking as a cyclic, interactive process of perception, inner images, and externalized images (p. 6-7).

Shepard (in Randhawa, 1978) has done extensive research on imagery and externalizing images and describes the latter in two senses: the inventive sense where creativity is manifested in concrete inventions and abstractions, and in attempts to externalize mental images by various methods including sketching. McKim (1972) says there are externalizations, that is, drawings or sketches, that are ready to use to communicate ideas to others and there are sketches made during attempts to clarify an initially vague thought. He refers to drawing as "graphic ideation" and claims the act helps the mind gain focus from images that previously were nebulous, provides a visible record of the thinking process for future referral, and extends and clarifies thinking (pp. 6-7).

THE METHOD

The type of research employed to develop the handbook was formative evaluation. The seven stages of the instructional product development cycle as described by Mink (1980) and the formative evaluation structure described by Sanders and Cunningham (1973) provided the research model.

THE INSTRUCTIONAL PRODUCT

The instructional product is a graphics handbook titled How To Use Simple Graphic Tools for Thinking, Planning and Problem Solving is in the final stages of field testing. As stated above, its purpose is to expand the ability of the learner for thinking visually by describing and illustrating ways to use "graphic tools" individually and in combinations. The "graphic tools" used are simple, geometric shapes -- point, line, circle, triangle, rectangle. Opportunities to develop visualizing and externalizing abilities, two vital activities that are essential to thinking visually, are provided in exercises found in each chapter.

Although a major influence on the product's content was *gestalt* psychology, where the shapes were originally identified, other works were influential (Albarn and Smith, 1977; Alexander, 1964; Brunon, 1971; Dreyfuss, 1972; Halprin, 1969; Luft, 1969; Straus, 1977). Graphic, conceptual languages developed for a variety of special uses were also influential: Alexander (1964) devised a patterned language for architects; Dreyfuss (1972), an industrial designer, devised a nonverbal international language of graphic signs; Brunon (1971), an architect-turned-facilitator, developed a way of sketching a group's ideas and problem solving processes; Halprin (1969), an environmental planner, created the RSVP Cycle for graphically expressing recurring human activities; Luft (1969) devised a graphic model, "the Johari Window", for understanding interpersonal behavior called ; Straus (1972), also an architect, devised graphic heuristic approaches for problem solving.

Diagram (Albarn and Smith,1977) and A Handbook for Visual Problem Solving (Lippitt, 1973) each present visual approaches to conceptualizing and thinking with simple shapes in combinations. Two specialists have developed visual/verbal formats to convey and enhance meaning: Braden (1983) and Sibbet (1983). Braden's "visible language" refers to arrangements of words on the page, usually written within geometric shapes, and Sibbet, a unique kind of group facilitator, uses cartoon-type sketches and a variety of visual/verbal formats to manage information generated by groups as they share ideas and make plans.

At the core of this "how-to" handbook is the premise that problems, situations, issues, ideas, change, etc., can be conceptualized, visualized, and expressed using simple graphic shapes. The learner acquires skills in expressing thought processes graphically, thereby gaining new insights and perceptions.

Arnheim's investigation of the relationship between perception and concept development has been instrumental to this study. He claims that "in the perception of shape lie the beginnings of concept formation" and that the "perception of shape is the grasping of structural features found in, or imposed upon, the stimulus material" (1969, p.27). Results from field testing indicate that field testers enhanced visual, conceptual thinking demonstrated by the ways that they used simple shapes more effectively and in increasingly more complex combinations to externalize original ideas and clarify problems.

The instructional product is described in detail elsewhere in this publication.

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An Adult Handbook to Develop Visual Thinking: How to Use Simple Graphic Tools for Thinking, Planning, and Problem Solving

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Introduction

The handbook described here was developed to help adults think in new ways, especially in visual and holistic ways, about personal and professional problems confronting them, and as a result expand possibilities for problem solving. Typically problems are defined verbally only, a practice that limits how problems are initially conceptualized and solutions subsequently developed. Adults in various walks of life can benefit from applying visual techniques to their everyday problems similar to those techniques used in the visual arts by specialists who combine visual and verbal processes very practically and successfully.

Courses in visual communication are offered more broadly than ever before and adults who have access to such courses are fortunate. However, many adults do not have access to such courses yet want to expand their problem-solving skills. This handbook, How To Use Simple Graphic Tools For Thinking, Planning and Problem Solving, is directed to motivated, self-directed adult learners.

Context

Throughout most of history society was stable and predictable. Problems were perceived to fall into categories and in order to solve one, it only needed to be put into the right category, then the right solution was plucked from a sack of solutions gathered to deal with that category of problem. No more. Change is now the constant; predictability becomes more and more elusive. As society moves through rapid social and technological change and life becomes more complex, new problems and challenges, substantively different from those met in the past, now confront us.

For those responsible for identifying issues and solving problems, the ability to perceive and adequately conceive and convey problems in all their newly-found complexity is often lacking. Verbal-only approaches are inadequate. Major social problems of poverty, violence, drug abuse, teen pregnancy, illiteracy, etc., remain unsolved major social problems in spite of considerable funds and all manner of programs designed to overcome them. There must be new ways of thinking about problems.

Two writers, C. H. Waddington from biological science and T. Harrell Allen from policy science, present similar arguments for dealing with today's complex issues: Employ a holistic perspective and a graphic language which together provide an overall picture. Waddington (1977) said that people find visual illustrations of ideas useful and enlightening and he promotes their use to help the reader's imagination grasp the gist of an idea. Waddington refers to graphics or illustrations as "change tools" because they change how we think. Waddington's use of the term "tools" to describe visual illustrations prompted the idea of using the term "graphic tools" to refer to the simple geometric shapes which form the core of the handbook .

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Allen (1977) concurs with Waddington and suggests the use of the "bi-partite" graph to show that social problems have more than one source and in order to solve them relationships among problems and their origins must be described.

The Instructional Product

How To Use Simple Graphic Tools For Thinking, Planning and Problem Solving is an eight-chapter handbook in a simple-to-complex sequence designed to increase visual awareness and promote visual thinking. The user is shown how to visualize thoughts, problems, ideas, notions, etc., by representing them with simple shapes. The product was conceived and developed as a handbook because this format provides the opportunity for the user to engage in a repeatable cyclic process of read-think-do-reflect.

In order to achieve the desired holistic, systems approach while increasing visual thinking, contexts of problems are referred to repeatedly when describing and illustrating uses for the shapes. The fact that a problem, issue, or idea does not exist in isolation but is found within a context, setting, environment, etc., must be taken into account if an accurate understanding of the problem is to be achieved.

In systems terms, the concepts presented in "Graphic Tools" concepts form the input of the learner's mental operations. Throughput, or transformation, takes place when "Graphic Tools" concepts are incorporated into thinking processes. Learner's output is demonstrated:

-increased visual awareness;
-the ability to conceptualize visually;
-the ability to recognize emerging patterns;
-the ability to specify relationships among problem parts and between the system and its environment; and
-the ability to engage in productive problem solving using various shapes individually and in combination.

The specific shapes, or "tools", were identified from *gestalt* psychology and from Donis Dondis' book, A Primer of Visual Literacy (1973). One "Graphic Tools" chapter is devoted to each shape: point, line, circle, triangle, square, and combinations of them. Additional chapters, "fuzzy ideas" (emergent notions) and outlining and mapping, were developed to deal with the kinds of complex issues that adults continually face.

Contents of the Handbook

The handbook contains the following sections:

The introduction discusses the visual aspects of bringing form to thoughts and ideas, states some benefits of thinking visually, and describes the visualizing-externalizing process.

Three pages of suggestions explain how to blend "Graphic Tools" with problem solving "idea triggers" to use in the exercises.

Eight chapters, one devoted to each shape, are point, line, circle, triangle, square, "fuzzy idea," outlining and mapping, and combinations of shapes.

The handbook is in the final stages of testing and it is anticipated revisions will be completed by December 1988 and published by April 1989. The study describing the development of the handbook is found elsewhere in this edition.

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The Recall of Quanitative Data and Graphic Format: An Experimental Study

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Introduction

The power provided by computer graphics systems has greatly facilitated the production of professional quality graphic materials. The versatility provided by the software has made it possible to present numerical information in a multitude of chart formats. Most software packages allow the users to readily display the same data in a variety of different formats by a few simple keystrokes. However, educators and instructional designers still lack the empirical evidence to assist them in determining the "right" type of graphics to use in a given learning situation.

Washburne (1927) investigated the effects of tabular, textual, and graphic arrangements on recall. This study tested recall of specific amounts, as well as static and dynamic comparisons and rank ordering. Watson and Driver (1983) found that three dimensional graphic plots did not result in greater recall of information than did tabular presentation data. Benbasat and Dexter (1986) concluded that tabular reports led to better decision making and graphical reports led to faster decision making when time constraints were low. However, a combined graphical-tabular report was found superior in terms of performance. Even though the use of graphics in instruction has generally been recommended in the literature (e.g., Miller, 1969; Shostack & Eddy, 1971; Takeuchi & Schmidt, 1980), there have not been extensive studies which investigated the effects of these formats on recall.

The general advantages of graphics in presentations have been delineated by Watson and Driver (1983). Some of these advantages include 1) the ability to stimulate the interest of the user, 2) to aid in grasping relationships, 3) to save time when viewing masses of data, 4) present at a glance a comprehensive view of the relationship between different categories of information, and 5) to assist in analytical thinking. However, there appears to be a lack of research that supports the above claims. Winn (1987, p. 192) stresses the importance of developing "lines of inquiry into the learning strategies studies use when working with graphic forms." It is important to discover how and what students are learning from graphics. Are some graphics more effective than others? Are some types of information better presented different in graphic forms? Designers and producers of visual materials must also be concerned with a number of considerations included the nature of the instructional task, the teaching and learning strategies to be employed, and the individual characteristics of the learner.

The term cognitive style has been employed to describe strategies or models of perceiving, organizing and processing stimuli. Field dependence as an aspect of cognitive style has been singled out as having major implications in the use of visual materials. Field dependence is important because it involves perceptual and problem-solving abilities, structuring a stimulus field, breaking up or disembedding such a field, suppressing irrelevant information, and dealing with high information load, all of which are relevant in the interpretation of data in graphic format. More specifically, it is of interest if there is any correlation between the various graphic formats and those individuals who are classified as field-dependent or field-independent. Field dependent students may have difficulty processing complex visual information (i.e., as a graphic format) unless it is presented in such a way as to compensate for specific processing deficiencies related to field-dependence.

Research Questions

The purpose of this study was to determine the effect of graphic format on the interpretation of numerical data. The formats used in this study were bar, line, table, and line-table graph. The three types of quantitative interpretation that were tested were specific amounts, and static and dynamic comparisons. It was also of interest to determine whether cognitive style (FD/FI) correlated with the ability of the subjects to interpret information in any particular chart format.

Methodology

The subjects for this study were 96 undergraduate college students enrolled in professional education classes or introductory educational psychology classes within the College of Education. The subjects were given Group Embedded Figures Test (Witkin, Oltman, Raskin & Karp, 1971). The scores range from 0-18 with the higher scores indicating tendency toward field dependence.

The subjects were randomly assigned to one of four treatments which presented fictitious data in graphic form to alleviate any effect of prior knowledge. The fictitious data dealt with various European merchants income during the middle ages. The four treatments presented the same data in the following formats: 1) bar graph, 2) line graph, 3) table and 4) line-table combination. During the testing phase subjects responded by giving numerical or verbal answers in three categories: specific amounts as well as static and dynamic comparisons of the data. Example questions for each category are presented below.

Specific Amount

What was the income of the silk merchants in the year 1100?

Static comparison

Which group of merchants had the highest income in the year 1350?

Dynamic comparison

Which group of merchants had the greatest increase in income between the years 1100 and 1200?

All subjects in all treatments answered the same questions (each in the above three categories), the order of which was randomly altered for each treatment. The subjects were given the fictitious narrative and then shown a graphic format of the quantitative data, e.g., line graph on 35mm slide. The subjects had seven seconds to respond to each question while looking at the treatment slide, e.g., line graph.

A two-way analysis of variance was used to test the various null hypotheses in which the independent variables are type of graphic and type of recall. The design was a 3 x 2 factorial design based upon a mixed model which used a combination of between and within subjects methods (all subjects would respond to all types of questions) while viewing only one type of graph. The dependent variable was the interpretation of quantitative information. A correlation was conducted using the raw scores total and score on the (GEFT) (0-18) for each subject.

Results

The means of the raw scores are presented in Table 1 and the means of the scores as percent correct responses are presented in Table 2. A two dimensional (3x2) analysis of variance design was employed to test the research hypothesis. The summary table of the analysis of variance based upon the table of means (Table 1) is presented in Table 3. A total of 96 subjects were used in this analysis. The $\underline{F}$ ratio for type of graph ($\underline{F}(3,92) = 4.71$, $\underline{p} < .005$) was significant. The $\underline{F}$ ratio for type of question ($\underline{F}(2,184) = 46.56$, $\underline{p} < .0001$) was also significant. The $\underline{F}(6,184) = .107$, $\underline{p} > .05$) between type of graph and type of question was not significant. The correlation coefficient of scores on the GEFT and the scores on the three types of questions was as follows: amount = 0.078, static = 0.182, and dynamic = 0.381. Figure 1 is a graphical representation of the means of the percent scores as function of type of graph and type of question.

Discussion

The post-hoc analyses of comparisons of means showed that $\underline{S}$s viewing the line graph had lower scores than for the table treatment for all three types (amount, static, dynamic) questions. This is a predicted result for the amount questions because the subjects simply had to read the data from the table. However, since the static and dynamic questions required the $\underline{S}$s to do comparisons in a given year (static) and scan across years (dynamic), the poor performance of the line treatment was unexpected and merits additional experimental work.

Subjects viewing the bar graph did not differ from the line graph treatment for any types of questions, but had lower scores for the amount and static questions when compared to the table treatment. The bar graph scores did not differ from the table for dynamic questions. The relatively poor performance of the bar group on the static questions also merits additional work. Future studies of this type should increase the amount of data in the table and decrease the time of each trial. Both of these conditions would provide a better approximation to conditions in a classroom or business meeting.

This study partially confirmed the results of Benbasat and Dexter (1966) in that tabular reports were better than graphical formats, but did not find that combined tabular and graphical (line-table) were superior to table in terms of performance. However, the Ss in Benbasat and Dexter (1966) did have much larger data sets to interpret which would favor the combined format.

This study did not produce much indication that there is a strong relationship between field dependent/independence and the scores on the different types of questions. However, it does not preclude the future investigation of cognitive style and the type of graphic presentation.

The preliminary nature of this study does not lend itself to conclusions which can be readily translated into specific recommendations for selecting graphic formats for business or educational environments. However, it does provide a basis for additional work which might lead to such practical applications.

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Table 1. Mean Raw Score as a Function of Type of Graph and Type of Question

Graph Type	Type of Question			Mean
	Amount	Static	Dynamic	
Line	12.67	12.83	10.63	12.04
Bar	12.83	12.96	11.58	12.46
Table	13.63	13.67	12.29	13.19
Line-Table	13.54	13.00	12.29	12.94
Mean	13.17	13.12	11.70	12.66

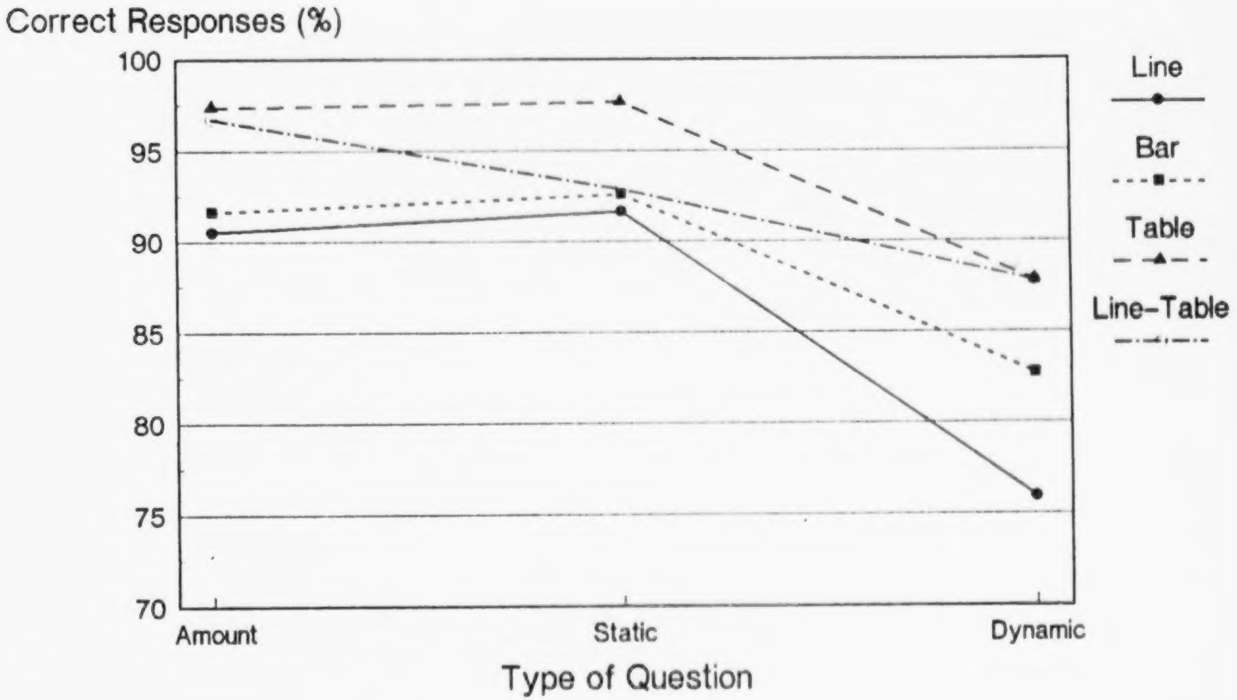
Table 2. Mean Percent Score as a Function of Type of Graph and Type of Quest

Graph Type	Type of Question			Mean
	Amount	Static	Dynamic	
Line	90.50	91.64	75.93	86.00
Bar	91.64	92.57	82.71	89.00
Table	97.36	97.64	87.78	94.21
Line-Table	96.71	92.86	87.78	92.43
Mean	94.07	93.71	83.57	90.43

Table 3. Summary of Analysis of Variance

Source	df	SS	MS	F	p
Between subjects					
G (Type of Graph)	3	56.85	18.95	4.71	< 0.005
Subjects w. groups	92	369.81	4.02		
Within subjects					
Q (Type of Question)	2	133.34	66.67	46.56	< 0.001
G X Q	6	15.22	2.54	1.78	n.s.
Q X subjects w. groups	184	263.44	1.43		

Figure 1. Percentage Correct Responses as a Function of Chart Type and Type of Question



Taft School Media Project, Year One: Uniting Video Production and Critical Television Viewing

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Educators have long recognized the value of media arts education as a partial antidote to the powerful and pervasive role of commercial television in the lives of American children. In the last several years, many schools have adopted programs which aim to teach children skills of critical television viewing. For example, emotionally disturbed children have been taught to make, discriminations between reality and fantasy on television (Sprafkin et al, 1988), and a focus on prosocial television encourages children to recognize the positive models that the medium provides (Abelman, 1987). Programs have been attempted at all educational levels, from preschool to post-graduate, to provide learners with a wide range of knowledge and skills regarding television.

Although "media literacy" programs have been used in schools for more than ten years (Lieberman, '1980), most approach the issue by developing students' knowledge about the medium, specifically by providing students with a better understanding of how television affects our consumer and social behavior, how television reflects and shapes social values, and how the medium developed historically (David and Maguire, 1983).

When video production skills are taught in the context of the high school classroom, the focus is generally on vocational preparation (Burke, 1986). In these programs, students learn to make news programs, game shows or documentaries. In the elementary or middle school classroom, video production skills are sometimes taught in the context of an art, social studies or literature course as a module; students make videotapes of a short story, or learn about color or composition by working with animation. Again, though, the programs emphasize using video as a motivational tool to help students appreciate the traditional curricula (Merrow, 1985).

This paper presents a brief description of a new program, begun in January 1988, designed to teach video production skills and critical television viewing to 7th graders in the Boston Public Schools. The curriculum attempts to integrate the the knowledge base of "media literacy" programs with a skills-based program to teach video production techniques. In this paper, we overview the origin of the project, the characteristics of the students and school, and the challenge of a complex collaborative project. Finally, we analyze what we believe is the best method to ensure that a healthy media arts program remains in place after our tenure at the Taft is completed.

THE PROJECT'S EVOLUTION

The Taft School Media Project was developed by a collaboration between the Boston Film/Video Foundation and the Taft Middle School in Brighton. The three-year project is funded by a grant from the Cultural Education Collaborative as one of the "ArtPartnerships," programs which develop links between cultural organizations and the public schools. The Cultural Education Collaborative is an agency supported by the Massachusetts Council for the Arts and Humanities, which focuses on the development of arts education.

Boston Film/Video Foundation is New England's major non-profit media arts organization. Over the years, BF/VF has developed an extensive program of media education, focusing on the needs of media professionals in the New England area. Courses in filmmaking, video production, computer graphics, scriptwriting and other technical skills serve as the basis of the adult-education curricula. In addition, BF/VF has a series of screening programs, and are committed to bringing the best in new media arts to the Boston area.

BF/VF's prime interest was in formally developing links to educational institutions in the Boston area. Says Elliott Kaplan, BF/VF Education Director, "From the organization point of view, our interest is in cultivating new audiences for the media arts. Unless we create programs to encourage children to develop an appreciation for the media arts, we'll lose our base of receptive audiences interested in aesthetic innovation in film and video."

A diverse group of collaborators was assembled to begin working on a idea for a media arts project with the Boston Public Schools, Tim Wright, a media artist and coordinator at the Southwest Corridor local cable access center, Karen Ellzey, a media intructor from Washington D.C. and me. Peggy Charren, founder and president of Action for Children's Television (ACT) served as our project's mentor.

We approached several Boston middle schools about our idea to integrate a video-production/critical viewing skills currricula in the context of a language arts and art classroom, and discovered the Taft Middle School in Brighton. Already well-known in the city for its innovative computer curriculum, the Taft School also employed Michael Johnson, a language arts teacher with a great interest in video production. Mr. Johnson hosts three weekly educational programs produced by the Boston Public Schools for cable access, called "LineBlasters," "Link Four," and "Junior Critics." These shows are educational game shows, in which students compete with each other to answer questions related to the subjects they've been studying in class.

Between September and December of 1987, the team of teachers, media artists, arts administrators, and I began the planning process. We focused on the idea of developing a "documenting" process, so that all of our work in the classroom would be recorded on videotape. We developed a training program so that students could be certified to use the video equipment outside of class to tape school activities.

Pragmatic concerns like scheduling became major obstacles in planning our first semester. Students at the Taft are split into a complex series of groups with periods of forty-five minutes in length. We knew that for our project we would need to see students for a longer period of time; the demands of video production necessitates a more substantial and prolonged amount of hands-on time with the instructors and the equipment. After much negotiating, we were able to obtain an alteration in the schedule, permitting us to have one classroom of students for two periods for one week, then another classroom of students for the double period for the second week. It was an imperfect solution, at best.

THE STUDENTS AND THE SCHOOL

Students at the Taft Middle School come from a wide range of neighborhoods in the city, including Roxbury, Mission Hill, and the Bromley Heath Housing Project. With court-ordered busing, the schools do not serve students in the nearby neighborhood, but draw from throughout the city. In addition, the groups of students in our project were "mainstreamed" to include bilingual students new to the United States, emotionally-impaired students, and learning disabled "special needs" students.

Almost all the students come from economically disadvantaged families. Approximately thirty percent of the students are African-Americans, thirty percent Hispanic and twenty percent Asian. Almost half of the students do not speak English in the home. Yet, for these students, television is a major force in their lives, as they watch about seven hours a day, with more than half the families subscribing to cable television and about one-third owning VCR machines.

We recognized that to achieve the funding agency's goal of having a healthy media arts program in place after our three-year tenure was completed, we would need to involve a greater number of Taft Middle School teachers. To accomplish this goal, we held an all-day in-service education program for teachers in April of 1988. Ten teachers participated as we taught the basics of using the 8mm video cameras we had acquired for the school. Teachers showed a heightened interest when we made this equipment available to them for their own personal use outside the classroom. After considerable debate amongst the collaborators, we recognized that the first step was to get teachers to feel comfortable with the idea of video production. Letting them use the cameras for personal events helped accomplish this, although we were anxious about the possible negative consequences if the policy was misused.

We did not expect that our decision to invest in small, easy-to-use 8mm. video cameras and decks would prove troublesome, but we encountered the problem of teaching teachers and students how to copy tapes made on 8 mm. to VHS. Although we benefitted from the improved image quality the 8mm. equipment provides, we added an additional layer of technology when teachers and students want to play back their work, since VHS is the home-use standard, and only two 8mm. decks for playback were available. Copying tapes from one format to another was time-consuming and tedious.

A final problem was encountered in the issue of where and how to store the equipment in the school. Unlike the environments of wealthier suburban schools, which already has an array of mobile media equipment stored in specially built closets, the Taft Middle School has no such central location. We had worked with the school librarian in order to use the library storage closet, but over time, she found this arrangement unsatisfactory because of the increased traffic during her teaching periods. Finally, we found a suitable "cage" in the back of a teacher's room. The first year of the Taft Media Project illustrated that even small logistical concerns can be complex in the context of working within a poor urban school with few resources.

We conducted experimental research to determine the effects of the program on children's cognitive, visual thinking and creative skills. These findings are forthcoming (Hobbs, 1989). However, we did receive very visible confirmation that the program had clearly developed students' skills in communicating and working in small groups. Students themselves recognized the changes which resulted from their intensive teamwork, and media instructor Karen Ellzey commented on the social and communication skills development made in a particular Asian student, who was a recent immigrant and spoke little English. She noted, "This student went from being a detached, uninvolved shy student to one of the best directors in the group. The medium of video was a bridge to communicate his ideas to the rest of the class."

THE CHALLENGE OF COLLABORATION

The most exciting element of the Taft Media Project is working with a dynamic group of professional educators, all of whom share a genuine concern for expanding the role of media arts education, yet all of whom have different visions of the ways to execute that goal. For example, some project members are committed to the idea of introducing students to alternative media forms, especially video art, in order to help students develop an aesthetic that goes beyond commercial broadcasting. Others are more interested in seeing that students gain a critical awareness of the media forms that they view with such frequency, like commercial advertising, situation comedies and game shows.

Some team members value the need for students to create their own independent video projects, while others recognize the value of structuring student work in order to achieve worthwhile academic goals. Such differences ultimately enrich the media arts curriculum; however, they also serve as significant conflicts when choices must be made. Systematic efforts at negotiation and communication helped resolve many of these conflicts.

In one particular incident, team members came into conflict over the direction of a student-produced narrative that would serve as the major project for the second half of the semester. Students wrote a script, made storyboards, a shooting script, and acted the roles and did all the production work. They wrote a story which was extremely controversial to educators, about a misunderstanding between a student and teacher which occurs when the student sees the teacher giving another student drugs. The student believes she has witnessed illegal behavior, and the teacher ultimately loses his job. In the script, the drugs were actually a prescription that a parent had asked the teacher to give to the student.

The conflict between team members in the project concerned the "appropriateness" of the script. Did we want to appear to condone a story that was so closely tied to the students' experience with drugs? Did we want to provide students with the opportunity to develop their own ideas, to function creatively in expressing themselves, without censoring their work with our own values of appropriateness? These were the two positions-- as different as night and day-- that reflected different values about the need for student-centered independent creative products, and about the role of educators in shaping students' work.

Ultimately, the challenge of collaboration consists of trying to balance the multiple interests of the diverse group of educators, media professionals and administrators. Each of the collaborators brings to the experience his or her own values and sensibilities about the "best" way to implement the goals of the project. And even the goals are subject to discussion. As with most new curricula, there are many more good ideas than there is time to implement. Cooperation, compromise and communication are the only keys to creative an effective collaborative process.

ENSURING THE LONGEVITY OF THE TAFT MEDIA PROJECT

As with any innovation in the classroom, the major goal is to first motivate teachers to have the confidence and courage to try new things. Teachers in the Boston Public Schools, as in most large urban school systems, face a great deal of uncertainty and often a sense of powerlessness, with budget cuts, new textbooks and educational plans forced on them by a centralized administration, no money for supplies or materials, and considerable stress in the classroom from students who are themselves often troubled and difficult to manage.

Within this context, the greatest asset to ensuring the longevity of the Taft School Media Project is helping teachers acquire a sense of ownership about the project, rather than seeing it as yet another thing imposed upon them by outsiders. Our challenge is to help teachers use video in the classroom in a way that suits them best, providing them with expertise in using the resources in which they feel confident, and suggesting ways to make video production and critical television viewing more relevant to their own work. Only if this is accomplished can we hope to develop a program that will outlast our own tenure in the Taft School.

We believe that the work of student "documentarists" can serve as a catalyst to accomplish this. Students develop proficiency in using the medium of video and acquire new knowledge and skills that lets them criticize some of the mindless programming they see after school. More importantly, they practice the complex skills of creating, assembling and editing images and sounds to comunicate about the events and activities in their school. Teachers get a chance to observe students at work using the

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technology, plus gain the satisfaction of seeing themselves and their students as subjects of a documentary.

At the end of the 1988 program in June, the entire school community met to view the final products of the Taft Media Project. Tim Wright and Karen Ellzey had taken some of the footage produced by students and edited it into a twenty minute program. The pride of the students and the delight of the teachers viewing the program were unmistakable. We expect that, in next year's program, students themselves will be the editors and create the final products, since we are continuing to work with the "graduates" of our program in an "Media Club" afterschool project. In addition, we will continue to teach 7th graders and continue to develop our work with Taft teachers in in-service workshops, hoping to attract more interest in our project.

In "Toward Civilization: A Report on Arts Education," the National Education Association (NEA) reports that for most students, television provides them with their only experience with the arts. Yet, "because it takes a very long time for a new art form to become established as a basic part of the school curriculum, courses in film, television and radio are relatively rare in American schools" (p. 63).

Many educators are well aware of the critical importance of systematic education in the media arts. Our culture, in so many ways, is beginning to show the clear signs of "television-saturation." Television now educates with a focused, systematic curriculum which emphasizes only commercial interests. Few schools can compare with the pervasiveness of the TV screen.

However, curricula in the media arts is not a monolithic static product, to be adopted uniformly among "enlightened" schools. Because of the huge outlay of capital funds necessary to begin such programs-- with necessary video cameras, playback facilities, and tape expenses-- few media projects in schools have a long lifetime. Curriculum development is the process of adapting to the unique demands and challenges of the intructional environment. To make change in education, this process is essential.

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Education From The Sky - The Virginia Tech Experience With Satellites

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The Virginia Cooperative Graduate Engineering Program is in its sixth year of operation. The program was created in 1983 in order to fill a void in graduate engineering education in the Richmond area and has since expanded to include both in and out-of-state sites. The current program was the result of "The Report of the Governor's Task Force on Science and Technology in Virginia". In this report, it was cited that the problem of no engineering graduate program in some areas could be solved by offering courses from Virginia Tech and the University of Virginia. Thus, the program was created.

THE BEGINNING

Funds were appropriated by the General Assembly for an initial one year phase of the project. Subsequently, funds have been appropriated to continue and expand the program. Currently, courses are offered to approximately 30 sites in Virginia and other states.

The concept of "host institutions" was developed to provide logistical support locally as well as courses which would support the program. The other institutions of higher education in the program include, Virginia Commonwealth University, George Mason University, Old Dominion University, and Mary Washington College. In addition, two independent centers also are participants - the Lynchburg Center for Advanced Engineering and the Halifax County/South Boston Continuing Education Center.

Initially the program used the microwave system of the Virginia Public Television Stations and an Instructional Television Fixed Service (ITFS) system for broadcast of signals. As the program expanded and as there was a need to reach more remote areas of the state which could not be served by a terrestrial system, the obvious need for satellite delivery of courses was apparent. During the Spring of 1986, one course was telecast via satellite to Lynchburg, since the area could not receive an ITFS signal. Beginning with the 1986-87 academic year, all courses were transmitted by C-band satellite to university, industrial, and public television sites with downlinks and by ITFS to sites without satellite receivers. Only satellite delivery was used beginning in the Fall of 1987.

During the 1983-84 academic year, Virginia Tech provided courses in Electrical Engineering and Industrial Engineering and Operations Research while the University of Virginia offered courses in Civil Engineering and Materials Science. The courses were transmitted to classrooms at Virginia Commonwealth University in Richmond using the microwave system and ITFS. The program was well received by students and industry representatives. Surveys indicated that the students were satisfied with the television instruction and rated positively both the technical and instructional quality of the courses.

Because of the success of the project in Richmond, the 1984-86 Appropriations Act provided funds for expanding the program into Northern Virginia and the Hampton Roads area. Furthermore, the two universities increased the number of engineering courses offered by a factor of three so that in the biennium six courses per term were televised from each university. During the 1986-88 biennium, the number of courses offered was increased again so that each university would offer eight courses per term.

ENROLLMENT

Enrollments have grown steadily. In 1986-87 about one-half of all television enrollments were in Northern Virginia. Virginia Tech courses tend to attract more students, especially one course in Computer Architecture that enrolled a total of 148 students. Total course registrations for the year were 1,893, including 1,119 receiving courses via television.

COURSES AND CURRICULUM

All courses are taught at the graduate level and lead to a Master's degree at Virginia Tech or the University of Virginia. Currently Master's degree programs are offered by Virginia Tech in Industrial Engineering and Operations Research, Electrical Engineering, Mechanical Engineering, Civil Engineering, and Systems Engineering. The University of Virginia provides programs in Materials Science, Chemical Engineering, Electrical Engineering, Mechanical and Aerospace Engineering, Systems Engineering, and Civil Engineering. Old Dominion University began a curriculum in Engineering Management in 1988.

One of the primary purposes of the program is to offer a Master's degree to engineers who are practicing in the field who, otherwise, would not have the opportunity to obtain an advanced degree while working full time. This program allows any practicing engineer to obtain such a degree or to take courses which are of special interest in their line of work.

Economic development is a strong factor in regard to the Televised Graduate Engineering Program. Graduate courses offered to engineers at Virginia's industrial sites provides an additional incentive in attracting industries to establish plants and facilities in the Commonwealth. By providing opportunities in graduate engineering education, "high tech" industries will be attracted to Virginia. Supporting current educational needs of employees provides an opportunity for individual career growth. Retention of both industries and personnel is an important outcome sought through the televising of engineering courses.

Students enrolled in the program are admitted to one of the degree granting institutions. Program admission requirements for matriculating students are the same for all locations. There is a mix of courses so that qualified individuals working in industry, business, or government agencies can enter a program at the beginning of any given quarter or semester throughout the academic year. Since all classes originate with a campus based enrollment, once a course is advertised, it is assured of being offered through the televised system. In order to accommodate industrial site students, all classes are taught in late afternoon or early evening to facilitate schedules.

While all courses are offered for credit, individuals may elect to audit courses and be in a non-degree status. It is possible to obtain a degree entirely by television without ever coming to campus. The program is very liberal in regard to the transfer of credit. Courses may be interchanged between the degree granting universities as well as transfering credits from host institutions, if they are in direct support of the curriculum in which the student is enrolled. A cardinal rule, established at the inception of the program, is that 50% of the courses must be taken from the institution which grants the degree. Thus, a combination of courses is possible, and students have graduated who have taken courses from both the transmitting as well as host institutions in Virginia.

TECHNICAL COMPONENTS

The courses all originate live in specially built electronic classrooms. Students are present in the originating classroom as well as those at all viewing sites. Lecturers can utilize an overhead video camera, microcomputer output, video tape, slides, models, character generator, and a video writer. The overhead camera permits the teacher to use graphics which have been prepared by artists as well as those which he or she creates during the class. If graphics or other instructional materials are not being used, a camera at the back of the room views the instructor as ideas are being discussed. The decision regarding which camera is on line for television viewers is made by a producer/director in a control room at the rear of the electronic classroom.

One of the special features in live classes is the ability to interrupt the instructor when a question occurs. If questions are asked in the on-campus classroom, they may be heard throughout the system as each student has access to a voice activated microphone. Likewise, those persons viewing the program at remote sites have "press to talk" microphones which can be activated when a question needs to be asked. While the origination of the picture and sound are carried via satellite, the return audio is carried by telephone lines. All receive sites are connected through a "telephone bridge".

Individual courses offered are video taped while being taught. Tapes are made available at designated remote sites for review if an off-campus student misses a regularly scheduled class. If a system malfunction occurs, tapes are dispatched to the various remote locations. All tapes bear a copyright notice and are erased at the completion of the school year.

Most classes have assigned textbooks and may have additional reference materials. Class notes and other handouts are provided by the instructors and distributed on-site to students by graduate assistants or industry coordinators. Tests, homework assignments, and final exams are administered by these assistants and returned to the instructor by a courier service. Students generally have access to on-site microcomputers at host institutions or at the industry where they work. Also provided is access to campus main-frame computer, facsimile for transmitting documents, and electronic mail between professors and students which can be used for any course.

PROGRAM EVALUATION

A formal on-going system evaluation effort has been established and the evaluation team provides an annual report regarding several facets of the program. The evaluation report is based on questionnaires distributed to students and faculty members in the program and on student performance.

In 1986-87, the on-campus students earned significantly higher grades than the televised students. However, both groups performed satisfactorily. Of the forty courses offered during the year, seven were too small to compare on-campus with TV students. Of the remaining thirty-three, eighteen did not differ significantly; however, fifteen did differ significantly, all favoring the on-campus students.

Students were asked to respond to several questions about the courses and instructors. Both TV and on-campus students gave the courses good ratings over the years. Textbook selection and classroom dynamics were rated lower than most of the characteristics by both groups. Problems with classroom dynamics may be inherent in the television format. TV students thought that the work load was perhaps a bit heavy. This may be inevitable for a group of students who are employed full time.

IN REVIEW

When one considers the many aspects of the program which are necessary to make it successful, numerous considerations for logistics must be taken into account. The maintenance and support elements of the system are wide and varied and include the following: 1) the acquisition, distribution, installation, and support of operating equipment at sending and receiving sites; 2) familiarizing faculty members with the network and assistance in the design and development of instructional materials; 3) the processing of student registrations and associated administrative needs; 4) providing resources required in support of classroom instruction both on and off-campus to include instructional materials, computer support, and other materials; 5) the specification, acquisition, and distribution of textbooks and support materials; 6) the distribution and retrieval of homework, tests, and exams; 7) the replication and distribution of video tapes covering lectures in the event of a failure in the system as well as providing viewing facilities at remote locations for taped programs; 8) advising of students about courses, curricular matters and developing plans of study.

While the requirements are many, the rewards are justified in that students have an opportunity for an advanced education which they would not otherwise be able to receive because of lack of educational opportunities in many areas of the Commonwealth. This unique program has provided service and opportunity to many people throughout the state. It is the result of government, higher education, industry, and public television working together to bring about this program. It has grown from a small beginning of two courses per university with one receive site to a multicourse offering to many receive sites that serve the needs of hundreds of engineers in Virginia. Without this program, the educational opportunity for practicing engineers would fall short. Through this program, Virginia Tech and the University of Virginia are able to serve numerous people in widely dispersed areas and aid in the economic development of the Commonwealth and the educational advancement of our people.

Visual Literacy and Political Cartoons: An Overview

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In secondary school social studies, history, and civics courses, many teachers make frequent use of newspapers to teach current events. An important element of newspapers is the political cartoon. After the headlines, the editorial cartoon is the most widely read part of the newspaper. It is a political weather vane that often exhibits the less gentle emotions of the artist and the people who share his opinion. Political cartoon are useful in teaching students the nuances of politics and the significance of relatively dry news stories. However, research has shown (Bedient and Moore, 1985) that the effectiveness of these illustrations should not be taken for granted. It seems that many assume that because an idea is being conveyed through a cartoon students will automatically understand it (Shaffer,1930). Many people confuse succinctness with simplicity. While political cartoons are indeed very succinct, they are in no way simple. In one study (Bedient and Moore, 1971), the vast majority of high school juniors could not abstractly interpret a political cartoon.

Need for the study

The views of the population at large are more and more today being influenced by the visual world. Television alone has made the candidate of today a packaged thirty second commercial with the visual impression created in that "spot" influencing the viewers more than the content of the politician's message. Kepplinger and Donsbach's study (1978) of the effect of camera angle on the perception of politicians showed that subjects who viewed shots taken from eye level judged the speaker more positively than subjects who viewed shots taken from a clear bottom or top view. This study points to the clear influence that visual images have on the viewers.

The use of another type of visual, political cartoons, is widespread in the classroom. Diederich and Maskovsky reported in 1970 that the American Newspaper Publishers Association's Newspapers in Education program involved 322 newspapers, 17,600 schools, and 48,000 teachers. It had reached over three million students with almost 68 million copies of newspapers.

Shaffer (1930) said that "cartoons are a desirable curriculum material for social studies in the junior high school...Children at this level can, in general, interpret cartoons abstractly." There have been a number of journal articles where the authors have suggested ways of incorporating the political cartoon into the classroom. Entin (1958) uses political cartoons in the classroom for promoting discussion. Eulie (1969) cites the positive use of political cartoons to facilitate interest and a deeper understanding in social studies students, provided that the teacher is careful in his choice of cartoons. Mattos (1972) suggests the use of political cartoons to spark students' interest in government. His idea that the teacher should build a case study of a political event through cartoons seems to be of particular merit.

There is ample evidence that newspapers and their incumbent editorial cartoons appear widely in the American classroom. There is not much evidence, beyond an a priori assumption, that students can understand and use these cartoons.

Interpretation of Political Cartoons

While there are many suggestions to use political cartoons in junior and senior high schools, there has been very little work done to find out if students can, in fact, understand them. Carl's study (1968) compared political cartoonists' intended meanings of their cartoons with those meanings interpreted by adults. He found that over 70% of those interviewed did not interpret the cartoons correctly.

In his heart model studies, Dwyer found that a high level of detail in a visual caused comprehension problems in students. The oftentimes intricately detailed political cartoons may contain too much information for students to process efficiently.

Bedient (1971) found that contrary to Shaffer, the vast majority, over 75%, of the 5th, 8th, and 11th grade subjects could not interpret political cartoons in a manner which could be called abstract and correct. An interesting side-light of Bedient's study was that intelligence was found to be an important factor. Two groups of eighth graders, one of average intelligence and one of above average intelligence, and a group of eleventh graders were compared in his study. The above average intelligence eighth graders consistently out-scored both of the other groups. What are the factors at work in this rather thorough lack of understanding among our school children?

Spaulding (1955) said that the audience must bring its past experience to a visual illustration for it to have any power. A problem with school children may be that they do not have the depth of past experience to bring to the subject. Bogardus (1945) observes that the cartoonist is able to create his effect in part because of the management of symbols which have long since been taken for granted in most adult readers. However, Osborne (1978) correctly said of political cartoons -- "as a practical matter, symbols taken for granted by most adult readers might not be within the experience of the adolescent reader." (p. 112) It may be that school age children do not have the social and cultural background needed to digest the cartoons. Kerrick (1955) showed that the images used in cartoons, because of several possible meanings, need some sort of grounding through the use of captioning.

Visual Literacy

"Visual literacy" is a term that has come into much use, but there is not yet a consensus on the definition. Greenlow (1976) described a visually literate person as one who views not only the surface patterns of an illustration, "but during 'visualizing' the person brings meaning to the image and reacts to the image in a critical manner." Sinatra (1986) is more succinct, "visual literacy itself is defined as the active reconstruction of past visual experience with incoming visual information to obtain meaning." This is correct as far as it goes, but it stops short of a full definition. He neglects to mention prerequisite nonvisual knowledge. In the interpretation of political cartoons in particular, there is certain outside contextual information that must be brought to bear. There is a point at which visual literacy will not guarantee an abstractly correct interpretation of the cartoon. For instance, if a student is not familiar with Joseph Biden, then being visually literate is not going to enable him to correctly abstract a cartoon dealing with Biden's plagiarism. This is a particular problem because of the temporal nature of political cartoons. For the purpose of this paper visual literacy is defined as the active reconstruction of past visual and non-visual experience with incoming visual/verbal information to obtain meaning.

On the understanding and "reading" of visuals McLuhan said that... "the reader is required to fill in meanings from his own perceptions. The experience is highly participatory" (Osborne, 1978). Medhurst and Desousa in their 1981 essay said, "Cartoons work to the extent that readers share in the communal consciousness, the available means of cultural symbology, and are able to recognize that shared locus of meaning as expressed by the caricature." This quality of participation that a student can lend to the experience of viewing a cartoon depends on factors that fall within the realm of cognitive psychology and prior knowledge.

The roles of prior knowledge and encoding strategies are integral to the successful interpretation of political cartoons. The viewer must be able to interpret the visual symbols and representations, and she must bring an awareness of the subject to the viewing. A difficult point in this task is that the prior knowledge needed to understand the political cartoon is in the form of both verbal and visual information. This is a potentially confounding factor in any empirical study to investigate students' ability to understand the visual elements of cartoons. It would be difficult to draw the line between a subject's political awareness of the topic and her ability to take that information (given that she has it) and translate it into the visual representations created by the artist.

This element of the students' visual understanding of the caricatures is pattern recognition. There must be some store of knowledge about the visual that can be applied for comprehension to take place. This store is also in the form of prior knowledge stored in long term memory. At this point in the students' understanding of the cartoon, he must be able to see that (for instance) the exaggerated wrinkles, bouffant hair style, and incipient grin represent President Reagan. The problem that is most likely to be encountered is the necessity for the student to translate verbal knowledge about the issue addressed in the cartoon into a visual representation.

A number of studies have indicated that pictures are not encoded in the same way as verbal information (Pavio, 1971; Nelson et al., 1974; and others). Related this, Dwyer (1987) stated, "in this respect probably the oldest and least controversial fact that can be derived from the research on human learning is that any change in the retrieval (evaluation) environment from that which occurred in the original learning environment produces marked decrements in learner performance." Lindsay and Norman (1977, p. 337) have stated, "the problem in learning new information is not getting the information into memory; it is making sure that it will be found later when it is needed." Even if the students had the political knowledge to understand the substance of the cartoon, they may have not been exposed to that information in a visual manner and therefore may not be able to make the connection between the politics and the cartoon.

Elements of Understanding

To this point in this paper it has been shown that political cartoons are used in the classroom, that there is much that needs to be brought to a visualization of the images for the viewer to comprehend them, and that this may be too much for students to understand without some sort of teaching. What follows is a compilation of some of the taxonomies of political cartoons. Through the use of these taxonomies, the teacher and the student can arrive at a better understanding of this type of visual.

Holmes (1969) suggested that the understanding of visuals depended upon three critical elements: 1) condensation, 2) awareness of incongruities, and, 3) ability to comprehend unusual symbolic representations. Fleming (1988) applied Bloom's taxonomy to the classroom situation. Medhurst and Desousa (1981) developed their own taxonomy from the rhetorical viewpoint. It is these last two items that will be used in unraveling the problems of comprehension.

Medhurst and Desousa's taxonomy of graphic discourse bears a great deal of attention. The elements of their taxonomy can be used as the common language in discussing editorial cartoons, and could, with some alteration, be applied to the larger world of visuals. Their taxonomy contains three main sections: rhetorical invention, graphic disposition, and rhetorical style.

Rhetorical invention is the first stage. It represents creation and/or the discovery of the subject matter. Four common sources are political commonplaces, literary/cultural allusions, personal character traits, and situational themes. Political commonplaces represent the necessary fodder of political cartoons. The economy, national defense, and foreign policy are typical of this category. Literary and cultural allusions can be represented by allusions to movies, literary figures, and quite often Biblical references. The third category draws upon personal character traits such as age, morality, and intelligence. Idiosyncratic and situational themes which appear and disappear make up the fourth category. These are the delight of the editorial cartoonist. The situation comes and goes from the national stage very quickly, but the editorial cartoonist seizes the moment to lampoon and satirize.

Graphic disposition is the next major component of the Medhurst taxonomy. The major form of disposition is contrast. The contrast of competing ideologies, wealth and poverty, or the contrast of sameness--a charge leveled at the Democrat candidates for President when they were portrayed as the seven dwarves. Medhurst and Desousa consider that there are two minor forms of disposition: commentary and contradiction. Commentary is just what it says it is; it is a statement of fact or cultural truisms. The second minor form of disposition is contradiction. Unlike contrast which invites comparison, contradiction invites, not attention, but condemnation. Contradiction invites no range of choice; instead, every reader is led to respond in the same way or to reject the appeal altogether.

The elements of rhetorical style include the use of line and form to create mood; the relative size of objects; the exaggeration or amplification of physical features; placement within the frame; the relation of text to visual imagery; and rhythmic montage, which is the interaction of all of the elements of the frame. "Montage is the way meanings evolve from the whole of the aesthetic and rhetorical artifact" (Medhurst and Desousa, p. 219). This in fact is the synthesis of elements in the visual communication.

Fleming (1988) adapted Bloom's taxonomy to form the "social studies cognitive levels" of interpreting political cartoons. His levels of understanding could be an important tool in evaluating and teaching the comprehension of political cartoons. Fleming's taxonomy is listed below.

1. Knowledge: At the knowledge level the student is asked to perform simple recall. "What does Uncle Sam represent in the cartoon?"

2. Comprehension: The student is asked to put information in another form. "What message is the cartoonist trying to convey in his cartoon?"

3. Application: The student is asked to select facts, principles, and/or generalizations and apply these to a particular problem. "Using the format of this cartoon, draw a cartoon on the role of the United States in the Middle East."

4. Analysis: Students identify and comprehend the elements or parts of a process, communication, or series of events. What are the most relevant points to be found in the cartoon?"

5. Synthesis: The students are encouraged to engage in original creative thinking. "Based on the five cartoons you have examined, write an essay on problems facing the United States in foreign policy."

6. Evaluation: Students are asked to determine how closely a concept or idea is consistent with standards or values. "How effectively does the cartoonist get his message across in this cartoon?"

These two taxonomies could be applied to the classroom situation to give both teacher and students a better understanding of political cartoons and how they work.

Summary

The problem that has been presented in this paper is that while political cartoons are in wide use in the junior high and high school classroom, there is little evidence that this use is effective. The inability to comprehend this type of visual is symptomatic of a larger misunderstanding of the visual and political world. Also shown is that there are tools presently available for use in the teaching and evaluating of political cartoons. It is the hypothesis of this writer that through the application of Fleming's editorial cartoon cognitive levels and Medhurst and Desousa's taxonomy, students in junior and senior high school who are exposed to current events can be taught to better interpret and understand political cartoons. It is hoped that through this application these students will be better able to cope, not only with the editorial page of newspapers, but with the visual world at large.

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Seeing is Believing: Visual Patterns Across the Curricula

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We have green blackboards, it gets as cold as hell, and toddlers ride three-wheeled bicycles. Decline of imagery can be traced in part to the deemphasis of visualization, or imaging, in school curricula (Sommer, 1978). This paper stresses the importance of visualization training throughout the school-aged years and suggests that the use of visual patterns is one way to accomplish visualization development. The natural pull of rhythm and order, the need for practice, the ability to understand visual beauty, the power of observation and patterns as a learning tool are discussed as bases for the place of visual patterns in formal education. The paper then turns to a specific curricular focus, differentiating between *seeing* patterns and *creating* patterns and giving direction for pattern integration across the disciplines.

Visualization in Education

Rationale

"What must be criticized is not abstraction itself...but abstraction at the expense of the senses rather than in conjunction with them." (Sommer, 1978, p. 3) There are basically two learning systems in American schools: the verbal and the visual. As students progress upward through the grades they gradually leave behind visual thinking for the abstract verbal thinking of the adult. According to Sommer, "It is a mistake to talk about abstract versus verbal thinking." (p. 72) The highest development of human thinking includes both verbal and imaging capabilities so that each can be called upon as needed. Visual thinking should be emphasized along with verbal thinking; the two should be reunited, remarried within the curricula set forth in formal education. There should be no dichotomy, but rather the two areas should be merged and interwoven across the disciplines and from kindergarten through grade twelve. The curricula can readily accomodate visualization training beyond kindergarten and outside the high school art classes in which it is currently found.

Visual Patterns

"Visualization" includes many components. Left alone, visualization (or imaging) would be too broad and too vague for focus and would elude the curricular structure. Visual patterns, as one component, provide a means to achieve and improve visualization skills of students. Visual patterns by definition are inherently structured. They are also ubiquitous, found throughout both man's creations and Nature's. This makes visual patterns an organized, consistent and relevant means by which to challenge and expand imaging and seeing. In addition, "pattern" is as natural to the animal kingdom as breathing, calling to us, some say, from even the depths of the womb. (Deri, 1984; Huntley, 1970).

Bases for Instruction

Inherent Rhythm

Psychology offers various perspectives on the inherent nature of pattern. Examples can be gleaned from developmental, psychoanalytic and Gestalt schools of thought. Developmentally, "...consider the pleasure induced by a simple rhythmic beat. This, familiar even to babes and primitive men, involves no ingredient of conscious education, being part of the universal inheritance of the race, related possibly to the rhythmic motion experienced by the unborn child in the comfortable security of the womb." (Huntley, 1970, p. 51) This quote and its context suggest that while complex rhythmic patterns require training for understanding, all of us are drawn to and appreciate a rhythmic beat or that consistent pulse known as tempo. How simple it is for the hypnotist to induce a trance through a visual rhythm. Likewise, the concert conductor can mesmermize with the baton, and the "dash-dash-dash" that enters our visual field from the open road dangerously reduces our alacrity to that of "highway hypnosis." One obvious hypothesis here is that pattern, as a form of rhythm, is something inherent and naturally developed.

From the psychoanalytic perspective, Anna Freud is interpreted by Deri (1984) who writes, "Symbol-forming, order-making, and ego-constructing processes are constitutionally given 'drives.' The psychic proclivity for pattern formation originates in the dynamic urges of the id; it is not simply superimposed by the 'exigencies of outside reality.'"

(p. 82) Others from this school project the creation of patterns back to a basic need, adding it to the quests for love, shelter and food (Sommer, 1978). Furthermore, Sigmond Freud claimed an ultimate rationality (i.e., order, structure, patterning) for the *irrational* saying that it too is subject to the general laws and patterns of functioning (Rosner & Abt, 1974).

Gestalt psychologists acknowledge each person's lifespace as a unique pattern. If a person has a good gestalt, this implies a well-ordered pattern, with a "coherent unity" or mutual interdependence between the individual patterns that make the gestalt. Both the external and psychic universe consist of patterned processes which follow gestalt laws of formation (Deri, 1984). Deri suggests a nonexample to point to a gestalt's function. When cancer cells proliferate inconsiderate of organismic laws, their violation of governing patterns causes abherrent malfunctioning.

Another way in which humankind proves its "pattern disposition" is by the tendency to uphold original gestalts once perceived, no matter how much distortion is imposed (Deri, 1984). For example, when a woman's face (with cape and hat) is presented in a consecutive series with gradual distortions, subjects retain the initial perception of the woman's face. Subjects shown only the distorted pictures see a strange animal, unrecognizable as a woman's face. A second experiment shows a cohesive unit of dots formed as a triangle. When these dots are spaced farther and farther apart, they are still perceived as a unified whole, a triangle. Subjects presented with the spaced dots see no pattern, but random dots. Gestalt psychologists attribute these results to the ego's order-creating functions (cf. Koffka, 1935; Kohler, 1929).

One final example comes from the art world, outside of social psychology. The surrealist Marc Chagall reorganizes the natural world by painting objects in most unlikely positions, e.g., a human with a cow's head. Yet, patrons are not disturbed by this chaos - indeed it is **not** chaos, because the ego can reorder the universe with the artist. Chagall has restructured reality in an organized, meaningful way. This truth is heightened when contrasted with psychotic art. The psychotic patient as artist also juxtaposes his figures in the most unlikely positions. His art, however, usually disturbs and jars the viewer. The patient does not reorder the universe, but disturbs it; he, in fact, creates chaos (Deri, 1984). The opposing responses of the viewers illustrate the drive in humans to see, create, and uphold order.

Practice

Given the above evidence and support for inherent tendencies and capabilities towards patterning, a question arises. Why does any of this need to be formally taught to increase visualization abilities? For one, the best suggestion for improving visualization seems to be practice, practice, and still more practice (Furst, 1972). Yet, most curricula require "...computerlike processing, storage, and recall." (Sommer, 1978, p. 54, 5) Students spend the majority of their classroom learning experiences mastering verbal information, reasoning, and abstract thinking. If visualization practice is to be availed, it will probably need to come through exisiting disciplines of study. The ubiquity and relevance of visual patterns easily accomodate this end, but educators must first realize the necessity of practice and then the potential of this route to visualization development.

The universal appreciation and understanding of rhythm and pattern reaches a limit when left soley to innate powers. Huntley's (1970) earlier quote is completed with, "But the complex rhythmic pattern produced by expert African or Indian drummers demands training for its artistic understanding." (p. 51) Inherent understanding takes us only so far before education is necessary. As another example, consider the equiangular spiral found in several members of a shell genus. The curve exerts its fascination and charm to those with little training but when, through education, the shell's curve is understood mathematically, its beauty reveals further treasures (Huntley). Thus, the understanding and appreciation of beauty, often seen through visual patterns, require both the training and practice that curricular support can lend.

Aesthetic Understanding

Visual patterns are a source of beauty and students have the right to an education which helps them fully appreciate this beauty. There are four ingredients of beauty specifically applicable to visual patterns. The first ingredient is the alteration of tension and relief (Huntley, 1970). This is a universal emotion, analogous in music to the pattern of the "dominant 7 - tonic" chord progression. In the visual arts, this tension is experienced through patterns of perplexity and illumination, or chaos followed by order. Both components of the pattern appear deliberately ordered or planned. A second pattern occurs when an expectation is fulfilled. The pattern components are expectation followed by realization (Huntley). Again, a music analogy is the tonic resolution signaling the end of a melody. Visually, the realization is the final "blue" in a repeated "green, yellow, blue" bead pattern. The beauty in this second pattern might be the closure of the expected pattern more than the pattern itself. In order to experience the fulfillment, however, one must first see and understand the pattern given. Along the same lines, the third ingredient is surprise at the unexpected (Huntley). This source of visual beauty also requires that the viewer first understand the pattern before appreciating the beauty, but this time it is the deviation that brings the visual delight. The deviation, no matter its placement in the pattern, accomplishes its effect by appearing structured and planned; the deviation upsets the pattern, not the viewer. The fourth ingredient is also based on surprise. This is the surprise and awe that come when a pattern emerges for the first time. The pattern may have existed all along but the viewer is just perceiving it. This is a revelatory perception of unsuspected relationships (Huntley).

Not every visual pattern automatically qualifies as a source of beauty. The mathematician G.H. Hardy (no date) wrote of patterns and beauty that the ideas or the colors or the words must fit together in a harmonious way. Samuel Coleridge returned again and again to define beauty as "unity in variety." He is cited by Bronowski (in Huntley, 1970, p. 14): "Science is nothing else than the search to discover unity in the wild variety of nature....Poetry, painting, the arts are the same search...for unity in variety." The visually educated know that it is usually not subject matter which evokes aesthetic pleasure, but the form and fit of the structured pattern of the object beheld.

Power of Observation

Another basis for providing visualization practice through patterning may be best illustrated in a story about Galileo. While visiting the cathedral in Pisa, Italy, Galeleo stood waiting in a hallway. As he watched a lamp swinging back and forth, his keen powers of observation discovered the pendulum principle of isochronism: the time span for the lamp's oscillations remained the same regardless of their ranges (Arieti, 1976). (Galileo was only seventeen years old!) Unfortunately, formal education in America may be training its students right out of such keen powers of observation. Young children's thinking is first dominated by pictures and images - they only gradually acquire words and abstract concepts. But when children enter school, imaging and visualization can be a distraction. Consider elementary reading material. Initially students are given books with mostly pictures. As reading skills improve, students find more words and less pictures until eventually even simple diagrammed illustrations may disappear completely (Sommer, 1978). Ideally, less pictures could increase visualization with elicitous content; on the average, however, it does not. If reduced to only verbal material, the material should at least induce imaging.

Passive looking is far inferior to visual exploration or thinking. In today's American society, "people are watching more and seeing less." (Sommer, 1978, p. 7) Observe tourists. Tourists tend to view the world through the lens of a camera rather than put their energy into keen observation and study of the sites. (Reviewing the captured 2-dimensional photographic image is **not** the same thing.) Schools should help train students to really see when they look. Educate them to see patterns in architecture, in the urban plan laid out on the map, on the hotel carpets and among the citrus groves as they travel. Pattern recognition and study will lead to further observations and wonderment. Students will learn not just to see the parabola in the dramatic pattern of a rainbow, but in the subtle arc of a flying stone or the water drops from a cascading fountain (Huntley, 1970). This is the true seeing, observation, ubiquity and beauty of visual patterns.

Learning Tool

As a final basis, visual patterns are important as a learning and problem solving tool. "When Newton saw [the] similarity between the apple and the moon, a new class was formed, to which an indefinite number of members could be added thereafter. The new object for which he was searching...was a class. The discovery of this class revealed a new way of looking at the universe, because each member of the class came to be recognized as having similar properties." (Arieti, 1976, p. 271) Newton saw a recurring property between the moon and an apple. Dimitri Mendelev astutely "noticed" repeated properites among groups of elements, leading him to arrange the Periodic Table of Elements. Both of these men used their powers of observation and found patterns between unlikely or previously classified objects. The recognition of similarities often leads to the formation of classes, or a system. In turn, systems can lead to principles. For example, one may observe the daily alteration of light and darkness, recurring again and again. This observation yields a general principle that night follows day (Arieti). Patterns viewed in this way are a useful learning tool, helping students to form and solve problems.

Visual patterns provide a learning tool by guarding against the assumption that good recall implies good understanding. Premature conclusions can be drawn regarding concept acquisition if the basis is recall of facts or surface level comprehension. Students asked to find or create patterns which correspond with verbal information and reasoning must necessarily grasp the verbal learning. In addition, visual patterns may challenge higher-level thinking skills because their characteristics make them an easy tool for comparison, contrast, systematizing, drawing conclusions, synthesizing, and abstracting. These ideas are further addressed in sections dealing directly with curricula.

To sum thus far, visual patterns are a dynamic part of visualization and learning. They provide a learning tool to practice visualization, challenge observation skills, and develop aesthetic insights. And to top it off, not only are humans innately given to patterning, but patterns are everywhere, making them a natural fit for school curricula.

Seeing Versus Creating Patterns

There is a difference between seeing patterns and creating patterns in the contexts of curricula. "Seeing" patterns means locating existing patterns. Hopefully, students asked to see patterns will also be asked to interpret and/or apply what is found. "Creating" patterns begins in the mind's eye as the students originate them. This may be an exercise soley for visualization practice or relate directly to an academic content.

Pattern creation builds visualization skills. This is because much of creative thinking involves the manipulation of visual images. Memory images are often symbols and thus conducive for meaning changes, or divergence. "Much of most creative thinking is done in images and...visual perception involves the sort of operation which was formerly considered the privilege of abstract reasoning." (Rosner & Abt, 1974, p.19)

Creating patterns also builds thinking skills. Those who will create patterns must first very sensitively "think through" or reason what has been experienced and observed. Creative patterning requires seeing and thinking beyond an appearance to the significant facts and forces of existence. Further, creative thinking is often the arrangement of old elements into new wholes. This is abstract reasoning at the level of problem solving because the creator must transform visual randomness (or what is thought to be randomness) into an organized structure: a visual pattern. "The creative person is able to transform the sea of irrelevancy in which he finds himself into a vision of order and beauty, or he sees how a tiny fragment of seeming cosmic futility collides and coincides with a piece of obviousness. He is provided with the capacity to transform randomness and disparity into organized structure." (Arieti, 1976, p. 405)

Within academic content, pattern creation can be used to visually represent a newly learned concept or to synthesize several ideas into a uniform visual whole. Existing patterns may be transformed or reconstructed, thus combining the two uses. Making one's own patterns is typically considered a more creative learning activity (in the generic sense) than is discovering an existing one. However, some of this can depend on the design of the learning tasks.

As forementioned, creating and discovering patterns both ensure understanding. This "insurance" links together two previous concepts: First, students should be asked to do more than recall facts to demonstrate their understanding and, secondly, concrete learning precedes abstract learning. People who see an actual object remember it better than those who see a picture of an object, and they better than those who only see the name of the object (Sommer, 1978). Likewise, students asked to visually discover or represent their knowledge are really invited to more thoroughly understand and integrate what they are learning. Alternating and combining patterning approaches will give variety to activities and exercise a broader range of thinking skills. Specific curricula (discussed next) can accomodate both pattern recognition and creation if educators are willing to expand beyond that which currently exists.

Patterns Across the Curricula

Existing Status

If mathematics, the sciences, language arts, and even physical education can so easily accomodate visual pattern activities, why are these activities not seen? Typically, such activities are seen, but only in three places. For one, Kindergarten classes are replete with rhythm and patterning tasks - visual, auditory and haptic. Kindergarteners play clapping games, visual discrimination games such as "I Spy", string beads, weave, group numbers into sets, etc., all of which contribute to their visualization development. Secondly, high school art classes usually incorporate pattern study and design into their curricula. And thirdly, pattern tasks scantily appear in geometry classes, although often from a teacher- or text-directed format in which students are told what to see rather than discovering patterns by and for themselves. Sadly, these three representations cover only two age groups and one "special interest" group. In order to show how visual patterning can reach across all school ages and curricula, the following sections are broken down by subject area. Age/grade levels are implicit within the subjects.

Math

Beginning with a very basic skill, counting must be more than repetitive recall. New Math has deprived learners of the rhythm and flow of numbers. Numbers require sensory content so that children grasp the feeling for the "beauty and play" in sequences, series, and powers (Sommer, 1978). Sequences, series and powers comprise mathematics and are themselves comprised of patterns, both concrete and abstract. Within all levels, as new concepts are introduced, students need the concrete patterns to master the abstract. For younger students, simple arithmetic skills are enhanced as students work with visual sets and repeated groupings. The Cuisinaire system encourages children to see patterns and groupings and understand them visually as well as motorically (Cuisinaire & Gattegno, 1961). The curriculum program entitled "Math Their Way" (Baratta-Lorton, 1976) ensures that students visually perceive basic skills before they learn rote counting and addition or subtraction facts. (ref.) "In mathematics we can find [an] example [of patterns] in the magic squares....A more serious example is the Chinese triangle. From matrices, groups, sets, we derive more modern illustrations..." (Huntley, 1970, p. 84) Matrices, groups and sets are found at all levels of math and provide easy access to visual patterns.

Perhaps the most accomodating area of mathematics is Geometry. Yet for all of the naturally occurring patterns, its potential is undertapped. There is the Pythagorean triangle, pentagonal star, Fibonacci number series, golden proportion, slope, symmetry, and angle (Doczi,1985; Ghyka,1977). These are built from patterns and they direct patterns; they are found throughout nature, and can be directly related one with the other. For example, the triangles found within the pentagonal star each have two equal sides that relate to the Fibonnaci number series. The sides of the Pythagorean triangle approximate a 3- 4- and 5-unit length that is frequently found in plant patterns (Doczi). Imagine if students were to discover such things for themselves!

Math content overlaps quite naturally into science. This quote is illustrative as it overlays exponential equations and the visual patterns of a shell's growth. "...[T]he claim to beauty at least in some areas of mathematics is not built on an artificial basis but grounded in the beauty of the natural world. For the law of biological growth, whether of a plant or an animal or any part of them [sic], is an exponential law." (Huntley, 1970, p. 57)

Science

The examples and applications of visual patterns in science are possibly endless. One can look inside and outside of humans to find evidence of pattern. Pattern and symmetry are the crucial ordering principles of the universe (Deri, 1984). In looking at biological science, Deri writes, "...no organic life is possible without some form of interaction across a superimpermeable boundary. In biology this boundary is an actual membrane, across which biochemical exchange processes take place. These membrane-crossing transactions result in structural and energic changes within the membrane itself, as well as in the regions on either side. The end result is morphological and physiological pattern development." (p. 62) The laws of genetics are also governed by patterns, symmetry and other visual structure. "Pair formation on the basis of symmetry underlies the unfolding of our biological existence." (Deri, p. 50, 51) Patterns are seen in and among cells, genes, chromosomes, gametes, molecular groupings, etc. (Mutations and abnormalities can extend the patterning concept into the breaking of patterns and those consequences.) With today's sophisticated technology, there is no reason why students should not be examining patterns under microscopes, with superscope representations (e.g., pictures from sonograms), and on video tape.

With or without advanced technology, nature and math combine well to create visual-pattern opportunities for studies in botony, ecology, horticulture, and physical science. For specific examples, remember the pentagon previously considered in mathematics. The pentagon forms a pattern within other patterns in nature. It is incorporated in the patterns of fruits and flowers. Apple blossoms are from one of several trees and bushes that grow according to the pattern of either the pentagon or its extension, the pentagonal star. In fact, when the edible fruits of such are cut through the girth, the seed structure reveals the pentagonal star pattern (Doczi, 1985). Another example is found in leaves. A lilac leaf's growth patterns are harmonious with root harmonies of music when observing the proportions of the veins and branches. Other leaves relate with the Fibonnaci number series. Patterns in nature and across the sciences serve curriculum integration well, which seems to be an emphasis in schools today.

Additional science fields reveal potential pattern usage. Consider weather cycles, cloud formations and astronomical patterns and phenomenon. Expanding further, with imagination and direction the social sciences can accomodate visual patterning through, for example, graphic portrayal of economical patterns, political structures and philosophical frameworks. These can be envisioned in the mind in other than a verbal form.

There is another subject area that, although typically left to the verbal domain, should accomodate visualization and visual patterning. But first, this quote should reiterate the importance of visual learning: "The word-dependent child will overlook nuances of shutters, shingles, roof lines, posts, drainage systems and other parts which make houses work and give each a separate identity." (Sommer, 1978, p. 55)

Language Arts

Sometime back, a national news program ran a series called "Why Can't Johnny Read?" Teachers, administrators, curricula, neighborhoods, etc. could all be pointed to as part of Johnny's problem. Sommer (1978) states that one reason Johnny cannot read is that Johnny cannot see. "Class exercises develop rapid naming, to the detriment of observing....Once having named an object, Johnny moves on to something else, the intellectual task of the moment being concluded." (p. 54)

This section addresses the Language Arts or English teacher whose primary domain is verbal. Visualization, it seems, takes a secondary role, but consider Lord Alfred Tennyson's analytical view of a flower. His is the voice of a scientist in his poem "Flower in the Crannied Wall."

> Flower in the crannied wall
> I pluck you out of the crannies,
> I hold you here, root and all, in my hand,
> Little flower - but if I could understand
> What you are, root and all, and all in all,
> I should know what God and man is.
> (in Abrams, et al., 1974)

Before students are assigned to compose prose, poems, creative essays, haiku, or even song lyrics, should they not intensely study their subjects? Looking for patterns in their subjects is one approach; another is visually representing compositions, in content or flow, through the creation of patterns. Regardless of which approach is taken, visualization cannot be left out of the writing process as of secondary importance.

Conclusion

Verbal thinking should not be unequivocally emphasized over visual thinking. Educators who embrace visual patterning and its end, visualization, as developmentally important and integrate skill-building activities into curricula, do their students a large favor. The recognition, discovery and creation of visual patterns form one means to accomplish visualization strength and development. This means serves the curricula well as both an academic learning tool and a way to integrate various disciplines. It serves humankind well because humans strive for order and beauty, and by enhancing inherent capabilities of understanding aesthetic beauty. And the means of visual patterning serves society well when its members possess trained powers of observation. "...Visual thinking is more than a special technique useful for creative artists or memory experts; it is a fact of experience for most adults and probably for all children. The atrophy or withering of visualization has effects on many different aspects of society." (Meyers, 1958)

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Effects of Prepared Visuals and Ability to Create Visual Images on Immediate Recall in Children

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Effects of Visuals and Visual Imagery on Encoding of Verbal Information

This study seeks to consider theories regarding the relationship of visuals to retention of verbal information and applicable research that has been conducted in this area of educational psychology. Paivio's dual-coding theory forms the basis for most of the recent research on this topic. The dual-coding theory assumes that visual and verbal information are encoded in two independent but related memory systems with the distinct possibility that processing occurs in different hemispheres of the brain. Paivio assumes that the greatest possibility of dual coding exists for pictures, then for concrete words and, finally, the lowest for abstract words (Zechmeister, 1982). This is due to the presumption that pictures are likely to be semantically encoded verbally as well as visually and concrete words are very easily imagined or visualized as a concurrent activity to encoding the verbal label. Abstract words, on the other hand, may not be easily pictured and, therefore, may be coded only verbally.

Investigators have consistently found visual stimuli or a combination of visual/verbal stimuli to produce superior recall and recognition when compared to verbal information alone. As reported in Human Memory (Zechmeister, 1982):

> Shepard (1967) found recognition memory for pictures to be better than that for either words or sentences. Standing, Conezio, and Haber (1970) found that recognition memory for pictures on an immediate retention test averaged better than 90% even when subjects viewed 2560 pictures. (p. 221)

Burton (1982) compared recall for pictures, printed words and spoken words with all data showing superior recall for pictures. There is strong evidence that meaningful, relevant visual representations do enhance retention of verbal material.

Many of the studies considered thus far have been related to learning somewhat rote information, such as paired-associate nouns. Levin, Shreberg, and Berry (1983) considered pictures as an aid to remembering prose containing abstract and unrelated conceptual information and found that pictures of an interactive nature were necessary. Individual pictures lacking this interaction were not effective for enhancing either amount remembered or organization.

This is supported by Rohwers' theory of form class effect which states that when pairs are accompanied by a connector, retention is related to the semantic elaboration of a relationship. Prepositions and verbs were shown to be more effective connectors than conjunctions because, generally, a relationship is implied (Yuille & Marschark, 1984). It follows that encoding of visual information depicting interaction would have this same connective effect.

Instructions to Image and the Development of Imagery Ability in Children

In an overview of this subject, Richardson (1980) concluded that:

> Experimental research on the value of instructions to use mental imagery in learning verbal material has generally demonstrated consistent, reliable and substantial improvements in performance. (p.71)

He suggests that this may be due to both the dual-coding of visual information and the process of visualization itself. "The elaboration of verbal material by the construction of mental images is known to affect long-term or secondary memory" (Richardson, 1980, p. 71). Positive effects of imagery can be further explained by the coding redundancy hypothesis (based on the work of Bower and Paivio), which states that "Memory performance varies with the number of alternative codes available for an item" (Richardson, 1980, p. 73). Paivio (1971) observed the same effect (as cited in Richardson, 1980):

> Any superiority observed under imagery mneumonic conditions may result from the addition of imagery to a verbal baseline laid down during the subject's initial representational or associative reactions to the to-be-learned items, i.e., two mediational systems are potentially available rather than one. (p. 73)

Numerous studies have been conducted with adult subjects. Jamieson & Schimpf (1980) reported that self-generated images produced better recall on paired-associate tasks than images specified by the examiner. They concluded that "internal and external image generation would differentially support memory to the extent that processes of image formation were differentially memorable" (p. 31).

Giesen and Peeck (1984) found that college students who were instructed to form mental images while reading a 2300-word story by Gorki showed better performance than a control group.

Hunter tested high and low imagers, according to Betts' Questionnaire Upon Mental Imagery, to determine if vivid imagers could perform as well with verbal stimuli as with pictorial. She concluded (Hunter, Moore & Wildman, 1983):

> Neither imagery ability, as measured by the Betts' test of mental imagery, nor the presentation mode -- words and pictures versus words only -- resulted in differential ability to recall paired associates for both the immediate and delayed tests. However, paired associates generated from concrete words resulted in significantly greater recall than did the abstract material, and these efforts held across both imagery ability levels and both presentation modes. (p.180)

More recent studies have considered visual imagery as a learning device. Sears and Johnson (1986) found visual imagery to be superior to verbal pronunciation of words for both spelling performance and retention "particularly when coupled with appropriate imagery suggestions that serve as visual memory locations for the visual code" (p. 230). They concluded that "maybe a mental picture is also worth a thousand pronunciations" (p. 233).

Forisha (1975) conducted a study of the development of mental imagery ability compared to verbal processes by administering a battery of nine tests to 200 students in grades one through five. She concluded that verbal processes and mental imagery develop in a curvilinear manner with parallel rates of change and that cognitive and subjective components of imagery are distinct from each other and from verbal abilities. Her findings support the findings of Piaget and Paivio that verbal and imaginal processes are independent traits whose development parallels each other rather than imaginal preceeding verbal as stated by Bruner (Forisha, 1975).

Other studies of imagery in children confirm that the ability to mediate may not develop until between eight and ten years of age (Yuille and Marschark, 1984). Pressley and Levin (1980) used first and sixth graders to study the effects of instructions to image and time allowed for the image formation. They found that the younger students needed a longer interval (12 seconds rather than 6) to mediate and that reminding students to use the images they had generated at the time of recall was essential for first but not sixth graders (Yuille and Marschark, 1984).

Cramer (1981) found that interactive imagery instructions facilitated performance for fifth but not first graders and hypothesized that this was due, at least in part, to the inability of many of the younger children to understand the interactive instruction. She drew this conclusion from questioning the children about the methods they used to remember (Yuille and Marschark, 1984).

In summary, research has shown that "imposed mediators, whether verbal elaborations or pictorial interactions, enhance memory, with the effectiveness of both types increasing with age" (Yuille and Marschark, 1984, p. 4). The most important element of imagery used to facilitate recall appears to be interaction which, according to Bower, may produce a cohesive effect increasing organization (Richardson, 1980).

Alesandrini (1982) suggests that meaningful learning can be facilitated proportionately by pictures, concrete verbal stimuli and imagery instructions with each supplying less support to the learner. From this model comes the conclusion that young children who are not able to image may be supported by the provision of pictures to generate cues for imagery. Guttman produced similar results that suggest partial pictures can be used to prompt imagery in children as young as six. He found that imagery was an effective memory aid under this condition (Yuille & Marschark, 1984).

Summary

Self-generated images have been shown to serve important organizational functions for children. According to Pressley, "organization has also been found to be important in children's free recall, and imagery has been implicated as one mode of organization" (Yuille & Marschark, 1984, p. 9). Levin suggests that for students who have adequate word recognition skills but still fail to comprehend, "generating images of prose content may be just the organizational strategy they need to foster comprehension" (Levin, 1981, p. 210).

Instructions to formulate a visual image may serve several distinct functions in the learning process. The image itself may serve the same purpose as a picture or prepared visual, that of increasing possibilities for encoding and retrieval from memory. It would follow, then that the image should be interactive to be effective as was found with pictures (Levin, 1983). Another function relating to memory is the semantic process involved in formulating the image. Both product and process may be important to retention. Finally, the organizational nature of the image may serve as a facilitator to group knowledge in cognitive structure in a meaningful way thereby enhancing possibilities of retention.

A Comparison of Prepared Visuals and Imagery on Recall for First, Third, and Fifth Grade Students

Introduction

The purpose of this study is to compare immediate recall of paired concrete nouns under three conditions:

(1) Verbal only - pairs pronounced with a 6-second pause between each pair;
(2) Prepared Visuals - pairs pronounced along with 6-second projection of a black-line drawing of interaction between the two nouns; and
(3) Imagery - students are instructed to image or "make a picture in your head" of the two nouns interacting as each pair is pronounced (6-second pause between pairs).

Materials

Materials needed include 15 pictures of two concrete nouns interacting or 15 overhead transparencies for group use and a prepared answer sheet for each student. The same 30 concrete nouns are used for the control (verbal only) group and the group instructed to image.

Procedure

Students were randomly assigned to groups. The following instructions were given by the examiner:

All Groups

I am interested in how students your age remember things. This is a short exercise to test how well you remember. After I finish with all three groups I will tell you what each group did and what the results were. Do not put your name on the answer sheet. You are not being graded. Please concentrate and do the best you can. Do not talk once we start.

Verbal Group

I am going to read 15 pairs of words to you giving you a few seconds to try to remember each pair. When we finish the list I will read the first word of each pair and ask you to write down the word that went with it. For example, I might say "bicycle/dog;" on the test when I say "bicycle" you would write "dog." Please do not say anything out loud. Spelling is not important. If you are not sure of the word, you may guess or leave that space blank. Are there any questions?

Prepared Visuals Group

I am going to read 15 pairs of words to you, giving you a few seconds to try to remember each pair. At the same time I will show you a picture of the two words together. For example, I might say "bicycle/dog" and show you a picture of a dog riding a bicycle. On the test when I say "bicycle" I want you to write down "dog." Please do not say anything out loud. Spelling is not important. If you are not sure of the word, you may guess or leave that space blank. Are there any questions?

Imagery Group

I am going to read 15 pairs of words to you, giving you a few seconds to try to remember each pair. During the time I give you, I would like for you to try to make a picture in your head of the two words together. For example, if I say "bicycle/dog" you might imagine a dog riding a bicycle or a bicycle with a dog chasing it. On the test when I say "bicycle" I want you to write "dog." Please do not say anything out loud. Spelling is not important. If you are not sure of the word, you may guess or leave that space blank. Are there any questions?

Results

A two-way ANOVA was employed to analyze the data, with grade level as one variable and treatment (verbal, prepared visuals, imagery instructions) as the second. The analysis yielded a significant difference ($F = 65.58$, $p < .001$) in the treatment effect and a significant difference ($F = 15.05$, $p < .001$) in the grade-level effect. There was no interaction. Post hoc tests showed significant differences among all treatment means. For the grade-level means, first and third graders were not significantly different, but fifth graders were significantly different. Group means and item-by-item results are presented in charts on the following pages.

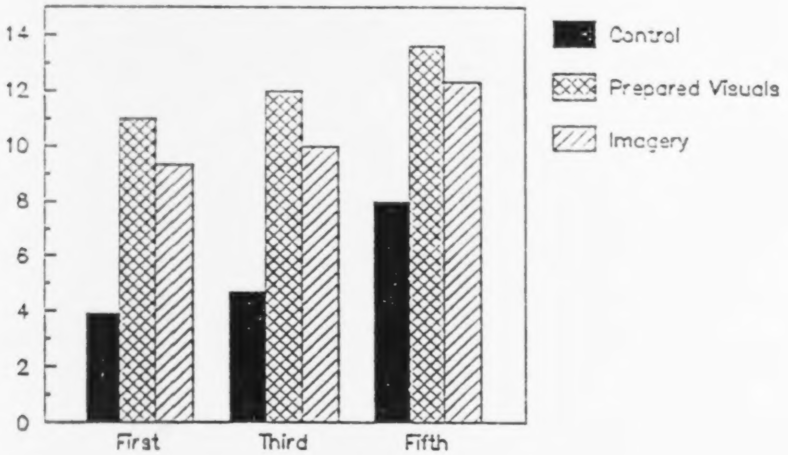
Discussion

This study produced no evidence to substantiate the theory that younger students are unable to use the technique of imagery to enhance memory. The results do, however, confirm Paivio's dual-code theory that assumes two separate but related memory systems for verbal and imaginal stimuli. Groups using pictures, either real or imagined, along with the words, exhibited a recall rate ranging from 70 to 182% higher than the verbal only groups.

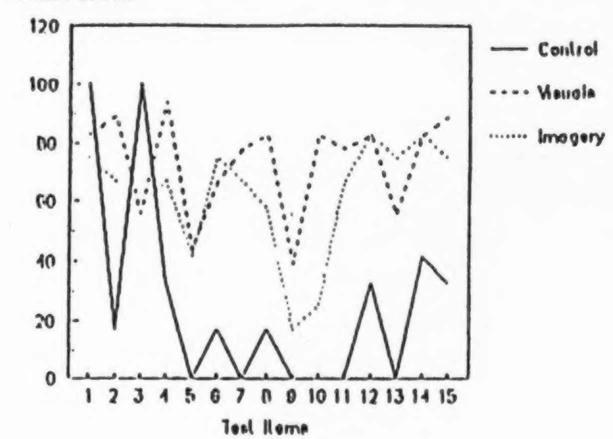
Conclusions

This study should be repeated using using an individual, verbal test to prevent confounding associated with the writing and spelling tasks and to eliminate factors such as group pressure. Further research could also be undertaken varying the amount of interaction and the time allowed for imagery. Retention after a longer period of time should also be considered as opposed to immediate recall.

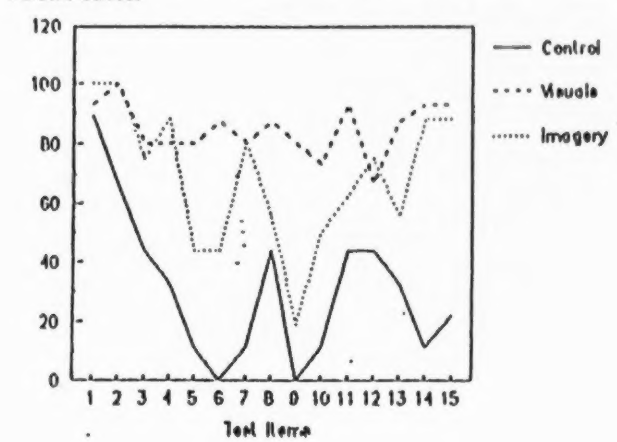
Comparison of Prepared Visuals and Imagery
Mean Scores



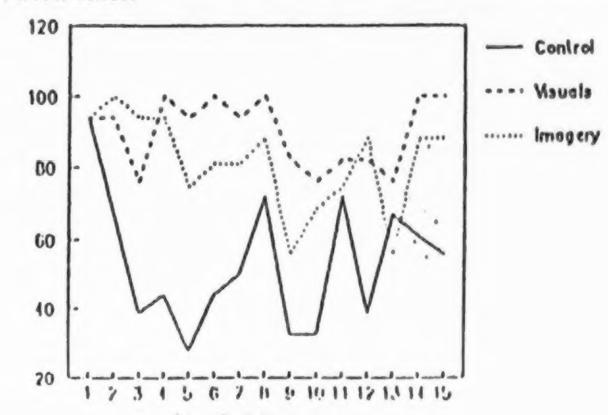
Prepared Visuals vs. Imagery
Percent Correct Recall by Item – First Grade



Prepared Visuals vs. Imagery
Percent Correct Recall by Item – Third Grade



Prepared Visuals vs. Imagery
Percent Correct Recall by Item – Fifth Grade



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Creativity Revisited in Computerland

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As the title of this paper suggests, the purpose here is to look again at the concept of creativity as an outlook on life, available to all, with specific reference to computers. This is not meant as a new thesis on creativity, but rather to suggest reasons for providing opportunity to young students for the creation of graphic images on a computer screen, using a program like Paintworks or a digitizing program such as the one demonstrated by Dr. Jim Andris at this conference. We will begin with some personal encounters with my own creative spirit and then move to a more generalized discussion of creativity, skill and self-image, suggesting ways computer activity can enhance these three elements of young lives.

My first little story will almost certainly date me, but maybe some of you can empathize. As a first grader, I, like my classmates, took my clay from my desk when told to do so (and never otherwise). I never really understood what we were supposed to do with it, and was sweatily concerned that my teacher and classmates would notice that fact. As I looked around, covertly, of course, I could see others making recognizable objects, and I assumed that was probably the purpose, but I could never think of anything to make. I decided on a strategy to cover up my lack of productivity. What I did was to make long ropes or coils of clay (taking care to not let them get too thin and break) which I would pretend to manipulate if anyone seemed to be paying attention to me. (I have only recently finished a novel in which the main character mentions mental hospital patient time spent with coils of clay. I dare not reflect on that for long, but even more recently I was in Taiwan and watched a craftsman in a curio shop fashion long ropes of a flour paste as he made a sea monster with long tentacles. So, maybe ropes of clay have their place.) I am not certain that we were supposed to be "creative" with that clay, but I know of no other purpose of the activity. Perhaps it was meant to serve as a break between Reading and Arithmetic, but I have never forgotten my feelings of ineptness and frustration at being defeated by a lump of clay.

In the third grade, I was in love with my teacher for a while, but one day she did something that changed all that. Everyone in class was working on an art project that involved painting a simple image on glass, backing it up with some sort of textured aluminum foil, making a sandwich by adding a cardboard backing and binding the edges with tape. Mine was a picture of a boat on water, done in a high contrast, black and white medium, and I was pretty content with what I had done--until my teacher came around to look at my work. She made some comment about needing some birds in the sky, took the brush from my hand and added them quickly. She also destroyed pride of ownership and accomplishment. She was right of course, that the sky needed birds--it probably needed clouds too, and I might have put them there, but we will never know. That picture wound up on a wall in my grandmother's house, but I never looked at it without remembering my sense of outrage when my teacher "stole" my picture, and sad to say, did serious damage to my self-image and skill level, not to mention my creative urges.

The next encounter with being creative came years later (by which time I was convinced that I was not "creative") when I was a graduate student at Indiana University. I had the good fortune to take some work in photography with Henry Smith in the Art Department there. Henry was a very special and unusual teacher, operating on an intellectual plane I could barely aspire to. The photographs I first produced for Henry were "first-grade clay," revisited. Everything I handed in looked like someone else's work. I was actually pretty skillful with a camera, but my images reflected nothing honest or clarifying about me or the way I viewed the world.

One day, in disgust, probably, Henry sent me out with my camera and told me to take pictures of anything I saw to which I had an emotional reaction. Now, that was a scary thought. He was telling me that my viewpoint and my emotions might actually be worth recording. Even more frightening was the notion that my images would allow others a window through which they could peek at my soul. Well--I did what he said to do. A fall rain forced me into the library, and I wandered into the stacks, where the floors were made of translucent glass. I saw a student sitting on that glass floor reading a book, and feeling the hint of an emotional reaction of some sort, I took a picture. It was not a great image, as it turned out, but Henry rejoiced over it, saying it was the first picture I had ever taken that was clearly mine alone. That incident opened the door to years of productive and often creative photography, some of it private, some of it public. It also eventually led to the development of a simple theory relating the dynamic interactions of skill, creativity and self-image which seems to me to have implications for the planning of computer activities in schools today. Each of those terms names facets of our individual lives which help define our uniqueness, and on which we spend a great deal of time in maintenance and/or improvement. Each needs some elaboration.

It seems to me that education is a social process, defined by Laswell (pp.337-353) as "people pursuing valued outcomes (values) within a resource environment." Within different cultures, organizations or individuals, these have differing specificity, but he believes these values can be generalized and named as follows:

1. Power
2. Enlightenment
3. Wealth
4. Well-being
5. Skill
6. Affection
7. Respect
8. Rectitude

Skill is specifically mentioned in this list, and self-image would seem to an expression of some or all of these items. Creativity is not mentioned as a value, which is curious, given the lip-service we pay it as a valued outcome of education. Perhaps it is a means to these other ends, or perhaps it, too, is the specific expression of one or more of the values listed. A more detailed discussion of skill, creativity and self-image is in order.

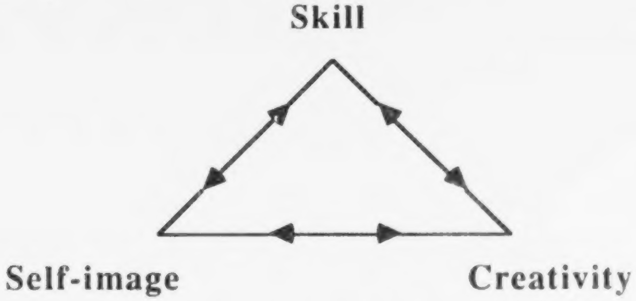
Level of skill is defined in terms of performance outcomes and predictions with respect to time and productivity in situations where the skill is applied. For instance, from the time I was five until I was about 20, I milked cows almost every day. I got to be very good at it, and came to know that if I got up in the morning at a certain time, I could always do the chores in time to get cleaned up and catch the bus to school. That was especially important to the cows because for most of my high school years I was legally bound to go to school, but was also personally responsible for the regular, periodic relief of the build-up of pressure in the udders under my care. The lesson learned is that a highly developed skill permits accurate predictions about the level of performance and about the time required to do it. As will be shown, skill feeds off of, and contributes to, creativity and self-image.

In the words of Bruner, and Torrance (p.2) would agree, I think, creativity is "effective surprise" (p.18). I do not know if Bruner achieved much acceptance for that definition of creativity, but I have encountered considerable resistance from students to the use of it. Bruner's definition demysticizes the term, and students are apparently confused or affronted by that. In this context, effective surprise means to me that any performance which is both effective and surprising is a creative one. The second occurrence of that performance may be effective, but is no longer surprising, and therefore, not creative. Repeated occurrences of that performance will eventually cause it to become a new skill, something the performer can do well in a predictable span of time. Conversely, previously learned skills are a necessary, but not sufficient, precondition of a creative act. A creative performance or product does not spring, full-blown, out of the ether. Creativity and skill tend to reside at opposite ends of the street, but often meet somewhere in the middle for some serious, dynamic and reinforcing interaction.

Self-image is an elusive concept. Boulding (p.71) says it is based on one's perceptions of one's place in the world, a composite of the messages received from others. I have not yet decided whether or not self-image and self-concept are the same, but for now, I will stick to Boulding's more old-fashioned term. Another old-fashioned but probably wrong notion is that weirdness (or abnormality) and creativity are bedfellows, the former being a necessary precondition for the latter. That noted psychologist and statistician, Willi Nelson, holds that no one is "normal", a proposition which makes a distinction between statistical normality and "real life" normality. This leads to the possible conclusion that we all are (at least a little) abnormal and therefore potentially creative. If we can be, and aren't, why not? It is not at all clear that creativity can be taught, but it does seem likely that we all have some measure of it. Its development and expression may be functions of individually acquired skills and self-image. Perhaps a partial answer lies in how each of us defines and prioritizes Laswell's list of values. If one's self-image requires messages confirming one's normality, one may have to be careful about exhibiting too much creativity.

So, what value do we give to self-image in its interactions with skill and creativity. I give it equal billing. I think of self-image as something that changes frequently, depending on messages received. Two of the forces that generate those messages are our individual skill and creativity as perceived and responded to by others. For instance, operating with a given skill level and self-image, one may be confronted with, or intentionally define, a problem to solve. When brought to bear on a specific problem, various appropriate skills, and the learned skill of purposive reshuffling of one's cognitive filing system (an "expert system" at work), may turn up a new, effective and surprising solution. That creative solution and the skills displayed generate messages from others which affect one's self-image. It may also be true that failure generates messages which affect self-image but in other directions. Of course, an accident may yield an effective surprise, and that can yield a new skill or may be discarded as having no future worth.

What we have here is a triangular, interactive and dynamic relationship which may be represented thusly:



At any given moment, each of us is probably more concerned with one of these elements than the others, but whatever changes we make in one of them, the other two will be affected.How does this notion of creativity relate to paint and digitizing computer programs?

Not so long ago, my two grandchildren (six and eight) were visiting in my home, and I booted Paintworks on my Apple IIGS for them. The ease with which they understood and applied my instructions was more than a little dismaying, given how long it had taken me to teach myself what they appeared to have been born with. Taking turns, they created images on the screen, and the younger of the two was at some pains to point out that his images were better than his sister's. We did not discuss our criteria, but I tended to agree with him. This was a way to create something that was effective and mildly surprising and it certainly was a way to be noticed and approved of by others. He is bright (do you know any grandchildren who are not?), and rambunctious, operating always on the verge of needing to be momentarily "reined-in." He generally receives fewer messages of approbation than does his sister, and though he seems not to care, his insistence on the superior quality of his images (coupled with an earlier oblique remark about his relative shortness of height) seems to suggest that he saw the creation of successful computer images as a way to even things up and to realize a more positive realignment of his self-image.

The products they produced are creative, at least in my eyes, because they are effective and surprising examples of how two children with quite different psychological makeups produce graphic art which is visually interesting and synchronous with other things I know about them. The girl is precise and orderly and very competent. The boy is all things stereotyped boys are supposed to be, and as noted above, his self-image is sometimes shaky, but he also (I think) displays a more intuitive sense of how to use a computer to express himself. Both children have utilized the computer's inherent abilities to express their individual essence, and I suspect, without giving much thought to it.

Computers are here to stay, even in schools. The graphic programs mentioned and demonstrated here today are typical of programs which are almost limitless in their ability to provide opportunities for random and/or intentional experimentation with color, size, reversed and mirror images, directionality, design, line and texture.

They are an engaging alternative to arcade kinds of games, and they offer, at a more sophisticated level, opportunities for simple word processing, experimenting with type faces and integration with other files.

It is possible, perhaps even likely, that an overbearing, insecure teacher might find a way to stifle a child's curiosity and inventiveness, but the attraction of computers will probably win out over that. Regardless of a child's immediate intent, building skills, improving self-image and being effectively surprising now and then would appear to be plausible outcomes of a young person's use of these programs. Perhaps it is the case that most of us are, or can be, creative to some degree. We ought to be comfortable with the normality of creativity in our lives and the daily uses it gets put to, as well as the happiness and self-content resulting from a problem creatively solved.

Conclusion

The kinds of learning activities in which these computer programs are used should not be mindless or lacking in focus. Their many features should be mastered by a teacher and specific assignments which use one or more of them could be developed, depending on the circumstances. The basic skills are easy enough to master, but the assignments should focus on controlled experimentation within the range of possibilities inherent in the program. Criteria for effective experimentation and creative results should be developed and explained to the students, but these should not militate against the production or recognition of an effective and surprising solution to the assigned problem. Allow the child to "own" the product, encourage the child to reproduce the product so that skill is developed, and when the product is a creative one, make sure the child is aware of that.

Part, perhaps, most of the learning activities suggested here and by Dr. Andris in his demonstration can be classified as skill-building. Literacy, be it verbal or visual, is possible only with the acquisition of appropriate skills. Many of those same skills applied to the creation of a product or the solution to a problem will result in something acceptable but not necessarily creative as defined in this paper. However, at some level of visual literacy, we ought to be able to expect creative output, and Dr. Andris and I propose that that level is more easily reached with visually oriented computer programs than in activities where the learning of the basic skills may take years. It is the essence of computers that they do more easily and more quickly (and often better) what some of us took years to master. Why not take the same advantage of that speed in visual activities as we do in other computer application.

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Visual Impact: Techniques in Video Production

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"Imagine a society in which everyone could read but only a select few could write. The large majority of people would not be able to express themselves nor would they understand the techniques being used to move them emotionally or to persuade them to a certain point of view. This is not a scenario from a science fiction novel but a contemporary view of television's place in our culture. Gradually, however, this is changing because of the proliferation of less expensive video equipment in the home and in the workplace, and in taking this course you will be in the forefront of our evolving media environment.

The primary objective of Intro to Television is to train you to be an effective television communicator. As such, students are expected to learn the medium's visual grammar, to have a firm grasp of production techniques, and to be able to responsibly operate studio and portable equipment. Readings, lectures, and discussions will provide an essential background to the terminology, techniques, and organization of television production personnel and equipment, while group projects will afford ample hands-on experience with the equipment as well as the opportunity to script and produce programs."

The preceding statement is taken from my syllabus for an Intro To Television course which is offered to undergraduates at Boston College. It attempts to strike the delicate balance between teaching visual languaging skills and technological competance. From the liberal arts and visual literacy perspectives the former is the preferred goal while the latter is a necessary prerequisite to the actual production of a visual message. This focus is also more likely to meet the students needs since the vast majority taking the introductory level course have no desire to become television production professionals. Instead in our society's ever-increasing reliance on the visual media, college students (and particularly communication majors) will need to acquire a fairly sophistocated appreciation and understanding of the visual language if they are to be able to critically evaluate and creatively manipulate it. In other words, they must learn anew to read and write.

Although the emphasis in a production course will inevitably focus on the creation of visual communications rather than on their critical analysis, these two activities are not only related but can be mutually sustaining. As the proponents of innovative writing classes on the elementary level will attest, improvement in writing skills very often leads to improvement in reading skills. One obvious reason for this interrelationship is that writers (whether for print or the visual media) must be there own best critics. They must acquire the facility to distance themselves from their work so that they might sharpen their technique to assure effective communication. Consequently, it is almost inevitable that critical viewing skills are established as an important component of evaluation in television production courses.

Ultimately, any recommendation for course design in television production should be flexible enough to fit into a bewildering variety of philosophically and technologically diverse settings. However, if one of the important objectives of the course is to teach visual literacy then certain fundamental approaches can be suggested. For example, the process of learning language skills is essentially the same whether it be spoken or visual. One should learn vocabulary and grammar before attempting to make a coherent and meaningful statement in the learned language. These are much more the implements of expression than the technology which only physically executes the intended message. This is not to say that students should be kept away from the equipment until they entirely or even fundamentally understand the concepts of visual expression. It is important that students begin to feel comfortable and competant in handling cameras, the switcher, and audio and lighting equipment as soon as possible. What is implied by this sequencing is that one cannot expect any sophistication in visual writing until the basic concepts are covered in lecture, discussions, readings, and demonstrations.

Most production classes take their cue from production texts and structure early lectures around the equipment. One class might be devoted to the television camera, how it functions as well as the principles of composition. Another class might be devoted to lighting and so on. Although this approach has much to recommend it since it is difficult to talk about implementing principles without also talking about the equipment, there is a need to balance this orientation with some initial discussion and illustrations of the pervasiveness and importance of the visual language within our society as well as some of its basic concepts. This establishes the focus and goals of the class from the beginning and for subsequent lectures on the elements of production it shifts the emphasis to the building of language skills. Discussions of production techniques then revolve around conveying meaning in addition to aesthetic considerations. Students begin to see that production is a creative decision-making process that demands an in depth understanding of what each aspect of the visual image and the soundtrack is saying to the viewers. Setting up hypothetical problem situations and asking the class for alternative solutions allows students to come up with their own applications for these concepts. What is the meaning conveyed by choosing a dissolve over a cut? How might context alter the meaning of each? What are the various ways to alter mood through lighting? How does altering the pacing of the shots, the angle or the lens of the camera change viewers' perceptions of an event or subject? How is the meaning of a shot changed by the shots which precede and follow it? These components of the visual messaging process along with many others become a palatte from which students can choose in completing later "hands-on" exercises.

Production exercises represent the core learning experiences for the class. As in any language or writing class, mastery depends upon performance. The process of constructing the visual statements which comprise a larger visual message is a creative problem-solving task which requires trial and error testing of conceptual solutions. In introductory classes, however, it is necessary that students are provided with enough structure in these exercises so that they are not overwhelmed by the magnitude of the task but are given ample latitude to be original.

There are many ways to structure student production exercises each with its own strengths and weaknesses. Although some introductory classes primarily teach single camera techniques (often as a result of a lack of studio facilities in smaller settings), multiple camera setups in small to large television studios are the more frequent choice for beginning students since they offer a more controlled learning atmosphere and an opportunity for direct observation and supervision by the instructor. Studio positions are also more highly defined. An excellent way to introduce students to crew positions as well as to the equipment is the rotation lab, in which a group of approximately six students is provided with a script provided by the instructor and they perform it six times with students rotating through each of the positions. For this exercise only a minimal number of crew positions is needed: director, switcher, audio person, two camera people and a talent. After this warmup lab, students generally feel more comfortable with the television personnel structure and the technology, and are now ready to originate their own program ideas.

Another decision faced by the instructor is whether to structure subsequent exercises as individual or group projects or to integrate the two. Some instructors opt to have students work in pairs. Individual projects offer the advantages having students come up with their own ideas and often directing their productions as well. The group approach, on the other hand, provides students with the time and the opportunity to perfect their program since there are more sources of creative input and from a purely logistical perspective more studio time can be afforded a few group projects as opposed to many individual projects. The strength of one approach is the weakness of the other and this why some instructors choose to alternate between the two.

Whatever approach is chosen instructors need to establish guidelines and expectations which will challenge students but are within the range of their present level of competancy. For example, students might be asked to create a production based on a given program type like interview or demonstration programs with a specified program length (e.g., five, ten or fifteen minutes). Certain production elements should be required, such as title graphics, credits, intro and outro music, a specified number of closeups and so forth. Most importantly, these guidelines provide the mechanism by which students learn how to manipulate the image through camera angles, movement and composition, special effects, pacing, and lighting. They also see how taken together these elements can create a reality of their own making and how they can have a real impact on an audience. Many are amazed, for instance, how much funnier a comedy becomes by simply cutting to reaction shots.

In order for this methodology to succeed, a good deal of emphasis must be placed on preplanning the production. Otherwise, student productions are doomed to failure because they no sense of the work required to complete the given task. Morever, their choice of production elements, the tools of the visual language, will be mostly haphazard and intuitive and, consequently, little learning can be anticipated. Preplanning materials should be handed in at least a week prior to the taping date. In addition to the script, these should include visualization aids such as floor and lighting plans and particularly the storyboard. The latter forces the students to think through the entire program visually. The objective is to provide the discipline by which students eventually can internalize this process so that they can visualize a sequence of actions or images as if they were watching it on a screen in front of them.

Following the final taping students are generally anxious to show their program to an audience and to get feedback from their instructor. The class usually serves an audience and it provides the producers of the program with some immediate feedback with regards to its impact. However, it is up to instructors to sensitively critique the final product explaining why it did or did not achieve its objectives. In their roles as critics, instructors must walk a thin line. On the one hand, learning will be severely limited without a fairly thorough analysis of the exercise from the dual perspectives of planning and execution. On the other hand, critiques should always strive to point out the strengths of the production while recognizing that criticism becomes counterproductive when it overwhelms the student. In the end it is the excitement that students feel when they can enlighten, persuade, or evoke emotion from an audience that motivates them to perfect their visual expression skills. Constructive criticism continually reminds that there might be a better approach in some critical aspects of the production while applauding their successes in others.

As You See It: Visual Literacy for Adults

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> "We are increasingly exposed to short blips of information - ads, commands, theories, shreds of blips of information - ads, commands, theories, shreds of news, truncated bits and blobs that refuse to fit neatly into our pre-existing mental files... and it comes in packages that are too oddly shaped, transient, and disconnected" (Toffler, 1981, p.166).

The purpose of this paper is to examine reasons why visual literacy should be incorporated in adult education, outline the universal objectives for visually literate adults, and examine activities that can be utilized to increase knowledge, understanding, and creation of visuals.

We live in a visual information society emphasizing visual communications and visual images. Berger (1972) has noted that "In no other form of society in history has there been such concentration of images, such a density of visual messages" (p.7).

More than a hundred years ago, a dramatic change in visual communication came about with the invention of the camera. Today we have an upsurge of visual messages. Print graphics (books, periodicals, newspapers, posters, t-shirts, billboards, signs), film, video, visual computers, television and art objects compete for our attention. Add in live action media such as body language, sign language and dance, and the need for a visual literacy becomes apparent.

REASONS FOR VISUAL LITERACY IN ADULT EDUCATION:

Most adults now receive much of their information, attitudes and general world views from such visual sources as photographs in magazines, film, commercial advertising, television and the computer screen (Roberts, 1977). The average U.S. adult is exposed to over 500 advertising messages daily, of which he or she consciously perceives around 75 (Key, 1977). Krupnick (1983) stated a Nielsen statistic that the average household now has its television on seven hours a day and a typical American watches TV over four hours and fifteen minutes a day.

The development of the media (particularly cable television), the advancement of technology, and the availability of computers are all contributing factors to changes in our definition not only of education but also of intelligence itself (Greh, 1984). Most adults were not exposed to visual literacy training during their formal education years. In a society rapidly becoming centered on technology and visual communication there is a need for development of visual skills for adults. Learning to see with care and skill should be top priority for all kinds of programs and courses in adult education. Helping adults see with a sensitive, knowledgeable, and critical eye should be integrated into all adult education curriculums.

"Visual literacy is the learned ability to interpret visual messages accurately and to create such messages" (Heinick, Molenda, & Russell, 1984, p.64). Communication by means of concrete visual images is not new. Visual communication was occurring at the time of the earliest cave paintings.

Visual literacy encompasses more than vision alone. It combines all senses and is the pathway through which ninety per cent of learning enters (Spoerner, 1981). At least 60 percent of forebrain activity (cognition, memory, emotion, and perception) is linked with vision. The neglect of visual literacy training is not sensible, practical, or understandable in this age of proliferating visual communications (Curtiss, 1987).

In the past the concept of literacy has applied only to the ability to read and write, but today a new concept of literacy, "visual literacy," came in response to the realization that specific skills are needed to "read" and "write" visual messages (Heinick, Molenda, & Russell, 1984).

UNIVERSAL OBJECTIVES FOR A VISUALLY LITERATE ADULT:

A visually literate adult will be able to:

1. Develop and expand a visual vocabulary.

2. Identify and interpret signs and symbols that people use to communicate.

3. Create mental images and consequent visual statements in response to the mental images.

4. Analyze and evaluate body movements (facial expression, gestures and posture).

5. Explore various media (print, film, video, and multimedia) and the ways in which they affect our values, reality, and ability to communicate.

6. Define man in terms of the symbols he uses to communicate his ideas and ideals in literature, poetry, art, and music.

7. Perceive and describe how various ways of seeing are influenced by personal experiences by language and society.

8. Investigate the manner in which art has been used as a vehicle for propaganda and protest and recognize the power of art to persuade through distortion.

9. Develop aesthetic judgments and become familiar with art and artists including the artist as a social critic.

10. Combat visual fatigue, media bombardment and sensory overload.

11. Recognize symbolism of a historical period and social and cultural differences in visual image.

12. Use critical thinking to analyze the motives, methods, and emotional appeal of visual advertisements.

13. Identify distortion, stereotyping, propaganda, and violence in visual media.

14. Construct and create visual images.

15. Grasp the idea that in our complex society we are dependent on instantaneous communications, and that television and computers are becoming our dominant cultural tools for selecting, gathering, storing, and conveying knowledge.

VISUAL LITERACY ACTIVITIES FOR ADULTS:

Visual literacy is different than verbal literacy. It is an unparalleled method of expression. To master it, the adult must work directly with images as well as talking or writing about them. The adult must work with the components of the visual vocabulary to learn to see and express himself/herself more clearly.

Elements of the visual vocabulary are color, shape, line, light, texture, pattern, perspective, point of view, angle, size, framing, motion, sequences, juxtaposition.

Resources for a variety of activities are simple and inexpensive. Resource collections should include magazines, graphics, comic books, cartoons, journals, books with interesting illustrations and photographs, videotape and film footage, and art objects (both commercial and instructional); still cameras, movie cameras and videotape systems are excellent visual and creative tools.

The following is a listing of general visual literacy activities that can be utilized with adults for interpreting, designing, and producing images. The activities are to help adults think visually and to be aware of visual ideas.

1. Compare print based information to image based information in any subject area. Is it easier to distort a message with words or with images?

2. Take an 8" x 10" sheet of paper and cut a small square (about 1/4") near the middle. Put the paper against your face and spend a full minute looking through the hole with one eye at any subject. Do you see things "more carefully" despite the fact that vision is limited?

3. Select visuals from any source. Write down why you have selected the

image. Be as specific as possible in relating the comments to the visual elements. e.g. "The red-on-red color scheme made me feel uncomfortable almost apprehensive", is more specific than "I didn't like all that red".

4. Use visual literacy criteria to appraise graphics, still and motion pictures, videos, multimedia, and visuals in textbooks.

5. Select and cut images that have totally different textures. Arrange in order from smooth to rough.

6. To show the power of simple lines make a non-representative "scribble" which shows or interprets a variety of emotions.

7. Design and produce visuals or graphics in any subject area and utilize the images to develop critical visual skills.

8. Analyze and evaluate the editing process in films or videos that are presented in class.

9. Utilize "fun" visual activities such as "Thingamajig" from Game magazine.

10. Select and present cartoons via transparency or handouts.

11. Classify realism in visuals by using examples of graphic symbols, cartoons, line drawings and photographs to represent a continuum of realism in images. e.g., a child's drawing of a kitty is less real than a Garfield cartoon, which in turn is less real then a photo, etc.

12. Bring visual literacy into the adult education classroom by way of handouts and syllabus. Use different colors of paper and ink, lettering styles, size of print and illustrations.

13. Contrast how cultural groups perceive visual materials in different ways.

14. Prepare examples of concrete poetry in a specific area of study. Let adult learners participate in creating their own concrete poetry. "Concrete poetry is poetry using a letter, a word, distortions of words, nonsense words or not words at all, using space around words to help the reader understand an idea. That is, concrete poems sometimes take on the shape of the ideas the authors are trying to share with you." (Pilon, 1972, p.16).

15. Assemble or construct objects that pertain to a specific subject area.

16. Conduct field trips to galleries, museums or other appropriate locations in respect to subject area.

17. Arrange displays of realia in a specific subject area.

18. Provide and compare a variety of books in a specific subject area with special consideration to visuals in the books.

19. Encourage creation of visuals in any format - assign projects that involve creation of visuals.

20. Describe and compare visuals from periodicals or journals in a specific field.

21. Utilize a variety of educational media in the classroom.

SUMMARY:

In the past, the concept of literacy has applied to the ability to read and write, but today with the increase in visual communication, the need for visual literacy training is apparent. Many adults are unaware about how images from a variety of sources affects their lives. Adult education can and should provide opportunities to help older learners increase their knowledge and comprehension and to encourage them to create visuals of their own.

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Graphics and Text Placement: The Effect of Wrap-Around and Framed Text on Reading Speed and Comprehension

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Desktop publishing is revolutionizing printing and publication. Computer programs such as Pagemaker, Adobe Illustrator, Power Point , Quark XPress, and Ready, Set, Go! offer the novice a wide range of techniques formerly available only to professional layout artists. Now anyone with an interest, a personal computer, and a few hours can save time and money by transforming existing art, whether it be clip art, photographs, or technical illustrations, into professional quality work that can be pasted into any variety of text formats.

Pagemaker, considered by many to have set the industry standard for versatility and ease of layout design, supports kerning, automatic hyphenation, and interactive facing pages. It allows users to change their view of the page, to resize proportionally, and to use a "grabber" to move specific parts of the page around. It features both run-around and wrap-around text. Run-around text is that which is "boxed" around the graphic, maintaining a square border around the visual. Wrap-around text is that which flows smoothly around the graphic and "hugs it tight",. leaving an irregularly shaped border.

Two other sophisticated desktop publishing programs feature enhancements to drawing. Adobe Illustrator is an artwork program that allows the user to draw illustrations from scratch or to trace existing art. The artwork can later be manipulated by rotating it, duplicating it, adding text or filling in missing sections. Power Point is a similar program which provides the illustrator with screens for designing slides or overhead transparencies.

Still other computer programs offer fully integrated desktop publishing systems. Quark XPress is one such integrated desktop publishing system which features full word processing, powerful layout capabilities and the ability to insert pictures in text by scanning or importing other manipulated images. It offers automatic text run-around of boxes and lines, as well as wrap-around features allowing text to automatically flow around irregularly shaped objects. Ready,Set,Go! is a similar program which integrates text and graphics. In this program both run-around and wrap-around text are described as advanced features which allow the designer to quickly and rapidly communicate ideas to the reader.

These computer programs have individualized the page layout process and have provided sophisticated graphic enhancements, such as run-around and wrap-around text, for computer users who have no training in either instructional development, page layout, or graphic design. And, teachers who use such computer software to design instructional materials are faced with a vast array of newly developed features with no guidelines for their effective use.

Examples of the use of run-around and wrap-around text can be found in consumer magazines and newspapers. Recipes are printed with the text boxed around a picture of a gourmet dinner. Articles in computer magazines describe the latest hardware and show the piece of equipment surrounded by fragments of sentences which detail its special features. In many instances, legibility appears severely restricted by the haphazard mixture of text and graphics. Guidelines are sometimes provided but they are often confusing. In one guide to basic design, a designer is told to "Frame your pictures with white space. White space separates headlines from surrounding body copy and artwork, making headlines easier to read" (Parker, 1987, pp 42-43). The examples show both run-around and wrap-around features being used.

Teachers who use computer programs to design instructional materials and integrate visuals in the text are asking for guidelines. How do these new desktop publishing enhancements affect the legibility of text? What is the optimal placement of text and graphic? How and where should white space be located to enhance reading comprehension? At what point does the integration of text and visual adversely affect legibility? How close to the visual should the text be placed?

PURPOSE OF THE STUDY

The primary purpose of this study was to determine the effects of two electronic text variables, run-around and wrap-around text, on reading speed and comprehension. A secondary purpose of the study was to determine whether it would be useful to develop guidelines for the placement of graphics within electronic text.

Many researchers have investigated layout, typographic cueing, and presentation of graphic materials in instructional text. Hartley (1985) determined that page size affects other layout decisions. In other recent studies comparing the effects of justified and unjustified text, reading speed and comprehension were not found to be significantly different (Campbell et al., 1981; Muncer et al, 1986). Jandreau et al.,(1986) have investigated the effects of varying spaces between phrases in sentences. Still others have examined certain design features common to printed and electronic text in the presentation of graphic materials (Alesandrini, 1987; Poggenpohl,1985; Winn,1987; Winn & Holliday, 1982). However, to date there has been no published research on the effect of various wrap-around enhancements with either printed or electronic text. Hartley (1987) and others have requested that such research be done.

Although certain features of electronic text can be transferred to printed text, there are many differences between the two which suggest that separate studies be done. The size of the screen or page, the type size and the ability to scroll are but a few of the differences which affect print and electronic text comparison studies. Because of these differences, a programmatic series of investigations is needed to examine the effects of these recent technological enhancements in each of the two media formats. Recent work by Morrison, Ross & O'Dell (1988) examines attributes of computer based instruction, and attempts to affect these attributes by regulating text density for print and screen display lessons. Results suggested that print had more advantages than the computer screen in achievement, completion time, and learning efficiency for a statistics lesson. Therefore, the present study is limited to the examination of print based computer generated text .

METHOD

Subjects

Ninety students from CBE 421, an introductory computer literacy course, participated in the study. Students were sophomores, juniors and seniors who had little or no exposure to computers before the course. The study was conducted at the beginning of the school year and all students in the course participated.

Materials.

Readings. Readings included approximately six pages of informative text about hypercard and desktop publishing. These materials were chosen because the topic was relevant to the subjects and because the reading level was geared for the general public as opposed to technical readers. The topic was suited to a novice audience with no prior knowledge about either hypercard or desktop publishing. The text was analyzed using the Flesch-Kincaid Readability formula and was found suitable for college students at the 11th and 13th grade levels.

Four sets of reading materials were used for this study. All included the same text and graphics, but each set was arranged differently on the page. The four sets included: one column of text with straight-framed graphics (run-around text), two columns of text with straight-framed graphics (run-around text), one column of text tightly fitted around the graphics (wrap-around text), and two columns of text tightly fitted around the graphics (wrap-around text).

Pre and Post-Tests. To measure the students' comprehension of the reading material, pre and post-tests were developed from key concepts which the authors extracted from the readings. The tests were developed and validated during a pilot phase of the project. The pre and post-tests were identical with one exception. The post-test contained an additional six-question attitude section. The attitude section included questions regarding the students' judgement of the difficulty of content, the degree to which graphics interfered with their comprehension and reading speed, their degree of interest in the subject, and their overall understanding of the material after reading it. These attitude questions were measured on a Likert-type scale and were not included in the post-test comprehension score.

Procedure.

All subjects were given a pre-test to determine their knowledge of the subject prior to reading. There was no time limit and students were free to take the time they needed to complete the test. Next, the four sets of reading materials were randomly distributed to the students so that each student received one set of articles. Students were instructed to read through the text one time without hurrying. When subjects were finished reading, each of their reading times was recorded. Immediately following the reading, the subjects were given the post-test for comprehension. They were allowed as much time as they needed to complete the test.

RESULTS

The design of the study was a two by two (2X2) completely crossed, between subjects factorial design using analysis of variance. Independent variables included text-graphic format (run-around and wrap-around text) and text columns (single and double column). Dependent measures included reading speed and gain in comprehension as measured by the difference between the pre and post-test scores. The alpha level for significance was set at .05.

Significant main effects were found for text format (wrap-around and run-around), but not for number of columns. It took students significantly less time to read wrap-around (tightly hugged) text than run-around (boxed). Students also demonstrated larger gains in reading comprehension when reading wrap-around text than when reading run-around text.

Tables 1 and 2 show the effects of reading gains by format. Table 1 shows a significant main effect for format, $F(1, 89) = 4.92$, $p < .05$. Table 2 shows results for the one way analysis of variance done to determine which format had the significantly higher gain. The higher score for wrap-around ($M=38.36$) indicates that the tightly hugged text resulted in greater reading gains than the boxed text.

Tables 3 and 4 show the effects of time to read the material by format. Once again, there is a significant main effect for format, $F(1,89) = 4.90$, $p. < .05$. Table 4 indicates the results of a one way analysis of variance to discover which format had the significant difference. Reading time for wrap-around text was ($M=12.59$), significantly less than it was for run-around text.

There were no significant differences for column, nor were there any significant interaction effects.

CONCLUSIONS

The amount of white space which surrounds a graphic appeared to have a significant effect on the ease with which text was read. Contrary to what one might

TABLE 1
Summary of Anova
Reading Gain by Format

Source	Mean sq.	df	F
Format	1020.10	1	4.92*
Column	107.95	1	.52
F X C	25.79	1	.13
Error	207.11	86	

*p < .05

TABLE 2
Reading Gains
Means and Standard Deviations

	Format		
	Run-around	Wrap-around	All
N	45.	45.	90.
Mean	31.62	38.36	34.99
SD	11.13	16.85	14.60

TABLE 3
Summary of Anova
Time by Format

Source	Mean Sq.	df	F
Format	30.04	1	4.06*
Column	2.18	1	.29
FXC	2.34	1	.32
Error	7.40	86	

*p < .05

TABLE 4
Reading Times
Means and Standard Deviations

	Format		
	Run-around	Wrap-around	All
N	45.	45.	90.
Mean	13.75	12.59	13.17
Sd	2.70	2.70	2.74

hypothesize, irregular lines of text around a graphic did not confuse the readers in this study. The distance between words of text, rather than the shape of the text when it surrounded a graphic, seemed to affect reading speed and comprehension in this study. The new enhancements currently available in desktop publishing software, particularly the wrap-around features, were not found to inhibit reading. Quite the opposite. Reading scores increased and reading times decreased when the text was "uptight" against the graphic. It appeared that when the distance between words was smaller, it positively affected reading time and gains even if the outlines of words were irregular. It would be useful to conduct a follow up study to determine the amount of distance between words at which these findings can be replicated.

However, a cautionary note must be added. One cannot assume that just because such new desktop publishing enhancements are available, that they will be used correctly by teachers and instructional designers. Teachers and trainers need guidelines drawn from studies on such special new software features as these to help when they design materials for learners. Appropriate guidelines addressing type of text material, size of graphic, amount of white space, and type of desktop publishing enhancement should be developed as these new special features appear on the market.

In view of unanticipated results, the authors recommend replication of this study with another group. If the results prove similar, guidelines should then be established to assist teachers and trainers in the appropriate use of this new type of desktop publishing feature.

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Look, Think, Act: Minneapolis Public Schools Program in Visual Education

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Minneapolis Public School District is a leader in the nation in its offering of alternative elementary educational settings that present different philosophic approaches to learning for children, parents, teachers and administrators: Open, Fundamentals, Contemporary, Montessori, Continuous Progress, and several more individual buildings that serve as magnets in fine arts, technology and environmental studies.

Cooper elementary is a Contemporary K-3 school in south Minneapolis, which means children are classified by age and skill level in kindergarten through third grade classrooms. A single classroom teacher directs most of the students' learning, with instruction in art, music, physical education and media provided by specialists in those areas. For some instructional purposes (Chapter 1, second-grade intervention, kindergarten transition), groups may be made up by achievement level from children in more than one classroom.

Contemporary schools were offered an opportunity to receive MPS Challenge Grants for the school year 1987-88 in order to add something unique to their programs that would fit the needs of the populations they served and bring attention to quality education in Contemporary Schools. Cooper Contemporary received a grant to offer a variety of visual experiences in an integrated arts program in order to foster students' visual literacy. Such visual education was felt to be increasingly important as a survival skill for children in a world in which visuals themselves are changing rapidly due to new technologies. "The goals of our project," stated principal Elmer Koch, "can help children develop greater awareness of their environment. Participation will have a positive impact on learning as children are motivated, gain in self-confidence and grow in creative expression."

The grant program was called "Look, Think, Act". The purpose was to encourage primary-age children to look more closely at the world around them, to think more carefully about what they see, and to act by responding to what they had learned.

The grant funded a day and a half of additional time for Cooper's media specialist and $2000 each for staff development and residencies by artists/dramatists. Cooper's media specialist, who submitted the grant on advisement of Cooper's principal and staff, acts as the MPS coordinator for Visual Education throughout the school district. As such, she had authored a 1986 MPS publication "Visual Education: An Interdisciplinary Approach For Students K-12 Using Visuals of All Kinds", which was used as a foundation for the pilot program at Cooper.

The "Look, Think, Act" Program

To kick off the new "Look, Think, Act" (or LTA) program in October 1987, all 300 students and 20 staff encircled the school -- stretching hand to hand -- to form a visual message of a giant "Super Hug", which was featured that night on a local television station's "Salute to Schools". (With everyone stretched around the building, how did they know when the "Hug" was accomplished? Room 203 began a chant, "We love Cooper! Pass it on!", which went from room to room until it returned to Room 203. It was so much fun, it was done several times.)

Then Cooper Contemporary got serious. Goals in visual education were selected by the staff: students would become more creative and critical thinkers by identifying, analyzing, interpreting and evaluating what they saw; they would become more perceptive individuals by recognizing and appreciating aesthetics of visual imagery; they would become more responsible citizens by being aware of the roles visuals play in society; and they would become lifelong learners, with a positive attitude about learning how to learn about visual images. Activities were prioritized to achieve these goals: student experiences in fantasy vs. reality, an option day with a variety of visual experiences, multicultural/multiethnic residencies, and other arts experiences in conjunction with Cooper's annual fine arts program. The media specialist was also designated as technology coordinator for film, video and computer graphics production.

An LTA Advisory Committee was established, with a representative from each grade level. In their planning for the year, they considered how to meet needs of the students (school-wide, in the classroom, or in small groups), needs of the teachers (skill development, lesson planning) and needs of the community (news releases, parent participation). A general plan was devised to integrate the LTA program into the classroom curriculum and into the fine arts program, with other special activities sponsored separately by LTA itself.

As support for the LTA program, Educational Media Services of MPS loaned Cooper enough televisions so that every classroom had one for the year. Broadcast and cable television programming could be used more effectively, videotapes could be shown to more than one room at the same time, and closed-circuit programs could be scheduled in which children and adults appeared live on a newly-established LTA-TV. The first telecast on LTA-TV was principal Koch reading a story to introduce his popular weekly reading club. This was followed by an entire month of read-alouds on TV by adults at Cooper and from the community. Other LTA-TV productions included such classroom projects as kindergarteners' play-acting of nursery rhymes, a demonstration of Japanese costumes, and book reports by students wearing Cooper t-shirts.

Another area of support came from Film In The Cities, a privately-funded Twin Cities organization specializing in film and video education and production. As part of one of its own grants, Film In The Cities chose MPS as an urban school district in which to focus its resources and expertise during the school year, and Cooper was one of four schools targeted for residencies by two media artists. One resident worked with Cooper teachers and students to plan and produce four videos. The other taught animation and original computer graphics for LTA-TV, complete with music composed and recorded by the students themselves. Both residents also conducted inservices for the Cooper staff and participated in a city-wide workshop featuring the Cooper productions.

Other residencies during the year included: storytelling by an Ojibwe elder and her students; South American, Russian and Egyptian musicians and dancers; a folk musician with a variety of instruments he had made; a children's theater group's performance of a participatory play; a pow wow in which everyone was invited to dance; and a four-day learning experience about Inuit life, art and culture, complete with an "Eskimo Olympics" in the gym. Field trips were arranged to the University of Minnesota for a Charles Schulz exhibit and to the Walker Art Center for a tour of its permanent collection.

Staff development during the year included: an "Acting For Nonactors" workshop in classroom activities; Minnesota Museum's "Talking About Art" workshop; an introduction for teachers to the Inuit residency; the Film in the Cities video inservice; and a metro-wide teachers' "Spotlight on Technology" workshop in which Cooper staff shared ideas they had developed. Books, slides, posters and other educational visuals were acquired for the school's permanent media collection.

An LTA options day was planned, in which all adults at Cooper offered fun classes that involved visual materials. The students chose which option to attend, from such classes as "Making Computer Pictures", "My Family Art", "Optical Illusions", "Design Your Own Stamp", "Making Hand Prints", "Native American Beadwork" and "Tell A Story From Pictures". Products that resulted from the options were displayed at the local branch of the public library as outreach to the community.

In addition to the "Super Hug" and options day, other school-wide activities included: door decorating about favorite books during "I Love To Read" month; "Computereyes" creation of every child's portrait using the computer; a student multi-cultural assembly with music and crafts from Mexico, Japan, Korea and Viet Nam; and "Look For Me At Cooper Contemporary" tote bags purchased for all children during School Pride Week. Special LTA-sponsored small group activities included: color-coded music composition classes; "Kidwriter" classes in computer graphics and word processing, in which five books of original stories and a "Visual Dictionary" were produced; a "structures" class in which fantastic objects were constructed from styrofoam; student video productions for LTA-TV; and a three-dimensional design class on picture-book art.

LTA communicated with parents and the community in many ways. An explanation of the program was made at a fall PTA meeting, followed during the winter by a demonstration of computers for parents. An LTA column appeared in each "Cooper Crier" parent newsletter. Parents were invited to all assemblies and residencies, and they saw their children's LTA-TV productions at Open House and Family Night. "Computereyes" portraits, objects produced during options, styrofoam structures, tote bags and "Kidwriter" books were all sent home with the children. A local television station sent its crew to Cooper three times during the year to cover LTA activities. News releases were written periodically for the MPS district newspaper. A report to MPS school board was made at the end of the year.

Conclusion

Four scrapbooks were compiled of Cooper's LTA year, and over thirty videotapes were edited to produce a seventeen-minute overview of the school's activities. These and other tools enabled the school district to evaluate its Challenge Grant.

The program's funding enabled Cooper's staff to arrange many activities of a visual nature for children. The next year, the staff continued to apply for other grants, hoping that the ideas and attitudes about visual learning would hopefully grow with students and adults alike.

At the end of the 1987-88 school year, most everyone agreed it had been a very good year to "Look For Us At Cooper Contemporary".

Infology and Desktop Publishing: Is There a Relationship?

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The 1980's have been characterized, somewhat glamourously, as the "Information Age." Information was not always this trendy - in the early 1960's, our fear of a data-crazed, computer-driven society was expressed in this plea: "I am a human being. Do not bend, fold, or mutilate." In 20 years, we've come a long way in thinking. Frank Herbert, the author of the science fiction classic Dune, grandly announced in a recent television commercial that "The real revolution of the Information Age will not be one of hardware, but of the human spirit. It will be the chance to become more than human."

Something has happened in the last two decades to change our attitude towards computerization and information. Parallel developments in the miniaturization of computer hardware and the global expansion of telecommunication networks have transformed the computer into an ubiquitous and even friendly presence in our lives. The monstrously sized computers of the 1950's have given way to the cute little Macintosh that sits on our desks, waiting to be petted and stroked like the family cat. Information in computerized form can now be bought and sold in the market place- it's a thing we can pay for, take home and own forever. Information has become an attractive commodity for venture capitalists and advertisers, and these two groups have transformed information from a want into a need (Roszak, 1986).

For all the high-tech glitz that surrounds information these days, the process of actually communicating information is essentially the same as it has been since the days of cave drawings- you think of something to say, you determine how to represent your thought and you send it , hoping that the receiver will interpret your message as you intended. What's changed is the ease with which anyone can send and design a message, and nowhere is this change more evident than in the advent of the desktop publishing program. Software programs such as Pagemaker have given us the capability to be our own Guttenbergs- creating text, designing illustrations, and formatting them into a visually pleasing, intellectually meaningful whole. On the surface this sort of power seems like a "good deal"- no editor breathing down our necks to cut 20 lines from the last section of our report, no graphic artist telling us that the visuals that we've created can't be executed. Yet like most good deals, desktop publishing is more problematic than it first appears. With the power of creation comes the responsibility of knowledge- knowing what kinds of illustrations will be most easily interpreted by your reader, knowing which colors will most dramatically enhance the impact of your image, and knowing how to combine text and graphics to communicate your message most effectively. Desktop publishing gives us the opportunity to combine the best fruits of our verbal and visual literacies. Unfortunately, most desktop publishers, whether they're creating business reports or editing newsletters, are more attuned to the effects of their verbal message than their visual message, and the total effect suffers as a result.

The emerging research field of infology may provide some guidance for the growing legion of desktop publishers. Infology is the "...theoretical and empirical study of the way text,images and graphical shapes can be combined to optimize communications between senders and receivers." (Pettersson,1988a,n.p.). This presentation explores the potential relationship between desktop publishing and infology by asking two questions: (1)What verbo-visual skills does desktop publishing demand of the user? (2) What concepts can infology provide for desktop-published documents?

What is desktop publishing? While every writer puts his own "spin" on the term, desktop publishing, in it most common form, is the process of creating textual and graphic information and formatting that information using a personal computer. To be considered a desktop publisher, you need to access three things: (1) a computer terminal, (2) some kind of laser jet printer and (3) an appropriate software package. The skills that one needs to publish in a desktop environment can be consolidated into 4 capabilities: (1) using multiple typefaces and fonts ,to represent a verbal message (2) using symbols and graphics to convey a visual message (3) combining text and graphics to communicate a single message (4) designing a page layout that showcases that message to its best advantage.

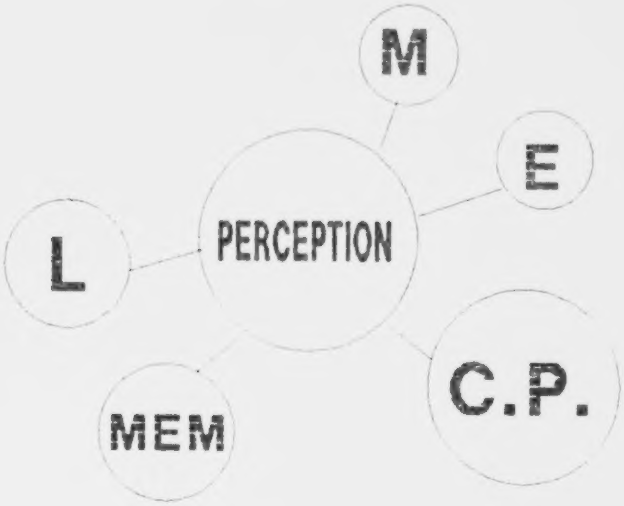
Desktop publishing is attractive because it provides independence at an increasingly affordable price. But the real power of these programs lies not in their ability to publish, but in their ability to "image"- in desktop publishing, we have a visual tool that allows us to use a completely new symbolic system to amplify our written communication (Murr and Williams, 1987). Priscilla Hardin, in her address before this group last year, noted that DTP allows the visual and content elements of a page to interact with each other from the start (Hardin, 1987). In a traditional linear publishing process, a message is composed and then the form of that message is designed- the order of these steps is definite and sequential. In desktop publishing, composition and design have become interactive steps, one process providing the information and decisions that drives the other process.

This interactivity mirrors the way we process information and ideas. Neurological research has documented how each side of the brain carries out separate and unique activities as we process stimuli from the environment. The left hemisphere is primarily our linear, language and logic processor; the right hemisphere is the nonlinear, pattern-recognizing, visual/ spatial processor. As we interpret the world around us, we process our impressions simultaneously in each hemisphere. The overlap region of our brains- the corpus callosum, where verbal and visual processing intersect- becomes a fertile ground for developing the mixture of text and graphics that characterizes symbolic communication. Desktop publishing is tailor-made for communicating this area of thought.

Most of us have become quite skilled at interpreting these symbolic messages as we receive them. Yet we are less skilled at sending symbolic communications- witness the number of poorly designed fliers and newsletters proliferating in our mailboxes. Traditionally, publishing has relied on text to interpret ideas and, as a result, we tend to predominantly use our left brains to gain understanding (Murr and Williams, 1987). Our public school systems have supported this emphasis as well- students participate in twelve years of language arts instruction regardless of linguistic ability. Yet only those students with a strong spatial aptitude- what my elementary school referred to as "artistically gifted"- are sent to more than rudimentary art classes (Hardin, 1987). The fact is that the majority of people creating DTP documents can express themselves well verbally, but they lack the experience to combine this message with well designed and supportive visualization.

Are there guidelines which will help us unleash the power of desktop publishing? Aldus Corporation, producers of PageMaker, and Hewlett-Packard, makers of Graphics Gallery, design manuals to assist the amateur publisher. Yet these manuals are only band-aid solutions at best. There is a need to comprehensively explore how people process and react to various combinations of text and graphics. Infology is addressing these concerns, among others, and an overview of some recent findings may provide some guidance for the desktop publisher.

Infological research synthesizes aspects of "established" disciplines such as information science, linguistics, semiology and communications to optimize our interaction with symbolic communication. A traditional view of communication pictures a sequential process with the source encoding a message to be sent to a receiver. An infological view of this same process amplifies the role of the receiver in achieving successful communication. The receivers interpretation of a message is based on an interaction of several variables:



An individual's mood , his prior experiences, the development of his cognitive processes (such as creativity and intelligence) and the interplay of memory and learning combine to dictate how we interpret a message. The message sender has little control over many of these variables and, not surprisingly, the receiver's perception often fails to coincide with the sender's intent. In a recent examination of perceived and real message content, the differences between intent and interpretation were measured at 22 scale units for text, 28 for pictures, 14 for graphical design and 26 units for overall impression, based on a differential scale ranging from 0 to 100 (Pettersson, 1988a). The implications for desktop publishers are clear- to improve the coincidence between perception and intention, we must choose our symbolic message carefully. There are three areas that desktop publishers should consider as they design text and graphics: (1) the process of perception (2)the symbolic representation of content and (3) the degree of ambiguity inherent in that representation.

Perception can be characterized as a two stage process. In the first stage, information processing is tentative, fast and unrefined, and gravitates towards those aspects which are large, brightly colored and deviate from familiar surroundings. We see what we need to see on this "first pass"- and in many cases, this rudimentary analysis is sufficient. The second stage of analysis is a more conscious action, demanding attention to detail and sequence. We weight various observations and hypotheses about the image against one another, and test their accuracy (Pettersson, 1988c). These stages employ different cognitive levels, as well. A low cognitive level operates during the cursory stage, and is characterized by a few rapid eye fixations and the formation of a quick, holistic interpretation of image content that is expressed in a limited number of words. A high cognitive level operates during the second processing stage- certain aspects of the image attract more eye fixations, information is processed several times (detail by detail) and verbal memory is activated to express this image in a greater number of words (Pettersson,1988c). Both halves of the brain are involved in image interpretation. In the first stage, right brain activity may predominate. In the second stage, left brain activity is paramount. Interpretation of highly integrated verbo-visual information, such as a television program, may engage both halves simultaneously (Pettersson, 1988b).

What does this research mean for the desktop publisher? Basically, it is a caution to design individual images with care, remembering that perceived image content is often different from intended image content. While the design of a picture can be changed a great deal without any major impact on content perception, content of the image is important in directing perception. Precise verbal expression combined with economically designed supportive visualization- exactly the kind of activity that desktop publishing is designed to accomplish- can close the gap between intent and perception.

Given that content is critical to the success of an image, what are the criterion for determining successful symbolic representation? Compared to traditional text-based presentations, the amount of information that can be comfortably contained in a visual display is limited. While different "rules of thumb" apply to different kinds of presentations, selectivity is a primary consideration. The display of numeric data is of particular concern to the amateur desktop publisher, and several recently completed studies provide some helpful criteria.

Ehlers (1984) points out that legibility is a problem in business graphics. The direction and pattern of graphic elements appear to be important factors, as well as the more traditional color and size variables. Further experiments reveal that the greater difference between colors in a graphic presentation, the more distinct is our perception of the border between the colors spaces (Fahlander and Zwierzak,1985). Certain colors used in business graphics have a higher aesthetic value than others, with blue, red and green being the most popular choices (Azoulay and Janson, 1985). Pettersson and Carlsson (1985) experimentally evaluated business graphics perception with respect to the relationships between variables and parts of a whole. Their findings, based on more than 2300 individual assessments offer these insights: (1) Graphical information is very effective in conveying a survey of a situation. (2) When relationships between variables are presented, comparisons of lengths give the best results. (3) While colors like blue, red and green are popular, their use does not improve our possibility of reading the message accurately. (4) When accuracy is needed, graphical information should be combined with actual figures.

A final area of consideration is the relative ambiguity of an image- in an information presentation, this question assumes even more importance. In comparison to text, a visual contains an infinite amount of information (Pettersson, 1985). There is often a major difference between denotation (actual meaning)of an image, its connotation (associative meaning) and our private associations. By exaggerating perspective, deforming shapes and making symbolic use of colors, an artist can easily create images which evoke extra association in viewers. However, an informative picture should not be open to different interpretations. As the number of elements in a picture increases, its potential for ambiguity increases as well. Given this prospect, it is important to remember that the number of graphic elements in a picture can be reduced without any major impact on content. (Pettersson, 1988c).

Is there any measure of how accurately a picture conveys information? Researchers in the Computerbased Learning Environments Laboratory at the University of Stockholm have developed a picture readability index called BLIX (an acronym for this term in Swedish) that evaluate 19 visual elements of a picture on a scale of 0 (virtually incomprehensible) to 5 (very comprehensible). (Pettersson, 1988c). Some of the variables used to compute this index are: external shape and contour, size, color vs. black and white, color intensity and contrast, realism, number of details, size, legend and relationship between legend and picture. While there is always a risk of interpreting index values as absolute, a rating like the BLIX index can provide the designer with a "ballpark" idea of how well an image conveys meaning. The ability of the receiver to study the contents of a word-picture is likely to increase if picture variables are designed with readability in mind.

Desktop publishing is a powerful tool that enhances our ability to communicate symbolically. With that power comes the responsibility of knowing how to design word-picture communications that are not only aesthetically pleasing but communicate what we intend. By exploring how the verbo-visual image is perceived, determining how its content is presented symbolically, and providing an index to evaluate picture readability, infology is potentially a rich source of guidance for the novice desktop publisher.

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Showing Students What Things Are: An Introduction to Basic Film Terms

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In English classrooms students are taught literary terms. They learn to differentiate plot from theme, to recognize direct and indirect characterization, to identify several types of conflict, and to list the important elements of a literary work (exposition, rising action, climax, falling action.) This is standard procedure and in this way, we help students see beneath the surface of what they read. The primary difference between my students and me when it comes to watching films is that they lack an educated awareness of what they see.

With the enormous amount of time young people spend each day "watching" and being manipulated by what they watch, it is disturbing to think that they are totally unaware of any visual techniques. They cannot see beneath the surface of the things they watch, and if they could they would not have the vocabulary to discuss what they saw. I believe the key to making them educated viewers is in making them aware of the control behind what they see. Just as teaching literary forms and identifying these terms in actual works of literature show students the author's control and skill, so identifying certain elements of video and giving students the language with which to discuss these elements, will make them aware of the techniques that are being used and remind them of the control behind what they watch.

I do not believe that movies or television or videos are categorically good or bad. I do not wish to discuss moral or ethical values here. I do believe that "watching" is an inescapable part of the life of young people and that what these people watch can have far-reaching effects on their lives. It seems reasonable, therefore, that a liberal arts education should include a course on how to become an intelligent and educated viewer.

As it happens, the summer I was working on this video project, I was also reading a science fiction novel by C. S. Lewis called Out of the Silent Planet. In this novel, the main character, Ransom, an inhabitant of the planet Earth, is kidnapped by two other earthlings who whisk him away to an alien planet. When Ransom lands on this planet, his first impressions of the landscape are confused because he finds that all he can discern are colors which "refuse.....to form themselves into things....he knew nothing yet well enough to see it." He concludes that this is as it should be because "you cannot see things till you know roughly what they are" (p. 40).
This is my philosophy in teaching this unit to young viewers. I hope they will be able to see because I have shown them roughly what things are.

What I have compiled here is a group of terms describing basic techniques used in making films which I believe are helpful for students if they are to understand film and if they are to speak knowledgeably about it. The terms themselves are defined in a sheet which is given to the student, but because the rote memorization of definitions is not very helpful in itself, I have also made a videotape to supplement this list. The videotape is a compilation of various examples of each term listed on the handout. As I show this videotape to my students, I pause to discuss the term and to check for student comprehension. (The Teacher's Guide for this unit is eighteen pages long and has a detailed description of each clip used on the videotape. In addition, it offers suggestions on how to teach each term and contains questions which can be used to determine student comprehension.)

The two primary considerations in teaching the terms are to show: (1) how the definition of the term relates to the visual image on the screen, and (2) how both the definition and the picture on the screen relate to what the camera is doing to cause this result. Control (by the director and the cameraman) is emphasized as are the conscious decisions that are made as the film is put together. This idea can be related to the control any artist has over his or her work, to show how the students can better understand art and literature by recognizing this control, and how they themselves can become the controllers when they work at their own pieces of writing.

I have tried to find some method in my madness. Sometimes I explain first and then show examples. Sometimes I do it the other way around. Sometimes I show a whole segment such as pan or dolly without stopping and at other times I stop after each example and explain and take questions from the students. I also talk during the video presentation occasionally to show a particular example, since the segments I use are sometimes as long as several minutes and the example I wish to present only a few seconds. (I remind the students that they do not need to hear all the dialogue because this is a lesson on visual techniques.) This is only a personal preference and a suggested way to approach the material. There are probably other approaches that would be successful and would work as well.

This unit is only about fifty minutes long if run straight through, but we usually allow three days to do it in class. (The discussion time between each of the sequences is necessary to the learning process and gives the teacher feedback on whether or not the students are mastering the material.) Because students seem to enjoy this unit and are already predisposed to visual literacy, they have little trouble in grasping the techniques. During the week we study this unit, students come to class delighted to relate a technique they recognized the previous night on TV. Because they are so anxious (and even proud) to show their newly-discovered skills, a test is necessary at the end of the unit. The problem is finding an effective test that can really evaluate their ability to recognize what they have learned.

In the past, I have taught this unit before showing a film that we were using in some other way in the class. In addition to this other objective (for instance, to relate the theme of the film to a previously read novel, to examine characters' motives and how they affect the plot, or to identify different types of conflict in the film) they identify three different film techniques, describe the scenes in which they were used, and discuss the effectiveness of these techniques. This works well because it gives them the entire film to choose from and the more advanced students can discuss the more subtle and unusual techniques, while the general students can pick out simple techniques and discuss the reasons for their use.

Another type of test, if a film is not going to be shown immediately after this unit, is to find three-to-five-minute segments from films which include several of the techniques covered in the unit. Each of these segments is shown at least twice (and perhaps three times) to the students. The students then identify film techniques and discuss their effectiveness. Three or four of these segments fills a class period, serves as a writing assignment, and gives the teacher a good indication of what the student has learned about film technique.

* * * *

FILM TERMS

SHOT - a single adjustment of the camera.

CUT - the instantaneous transition between two shots.

MATCH CUT - a cut in which the two shots joined are linked by a common visual, aural, or metaphorical element.

DISSOLVE - a transition in which the old shot gradually fades as the new shot appears, so that for a time the two visual images are superimposed upon each other.

LAP DISSOLVE - a dissolve in which the two shots joined are linked by a common visual, aural, or metaphorical element.

FADE TO BLACK (black-out) - the image on the screen gradually fades and the screen becomes black.

PAN - camera movement in which the camera pivots on a horizontal plane.

TILT - camera movement in which the camera pivots on a vertical plane.

DOLLY OR TRACKING SHOT - the camera is mounted on a small truck or wheeled platform (dolly) which moves along with the actors as they move.

CLOSE-UP - a shot in which the object being filmed fills much or all of the frame. If it is a person, we see only the face.

CLOSE SHOT - a shot near the object being filmed, but not so close that we cannot glimpse other elements of the setting. If it is a person, we see them from the shoulders up.

DISTANT SHOT - a shot which shows objects from a long distance.

LOW ANGLE - a shot in which the camera is pointed at the subject from below it.

HIGH ANGLE - a shot in which the camera is pointed at the subject from above it.

SUBJECTIVE - a shot or sequence of shots that allows the viewer to observe events from the point of view of one of the characters.

ESTABLISHING SHOT - a shot which orients us at the start of a scene before we get more detailed shots.

INSERT - a close shot providing explanatory detail, such as the contents of a letter, or the reading on a speedometer.

VOICE OVER - when a sound (most often a voice) is heard during a scene in which the speaker does not appear on the screen.

VOICE BRIDGE - when the voice of the person speaking is heard over a shot which comes before (or after) the shot in which the person appears.

BACK FOCUS - a technique in which the focus alternates between elements within a frame, for example when the camera is focused on a distant object which slowly becomes out of focus to reveal a closer object which is now in focus.

These terms are gathered from the books listed as works consulted and from my own knowledge of film techniques.

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Figure/Ground Anomalies in Commercial Television: A Diagnostic Study

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In the ongoing race to attract the attention of television viewers at any cost, writers, broadcasters, and advertisers have created serious anomalies in the visual communication process. The new computerized television technology, which allows broadcasters to present an incredible number of unconventional and unusual images, has succeeded in drawing viewers' attention by embodying the unexpected and reflecting the unorthodox. Short, fast-paced, compacted visuals, unorthodox backgrounds, unexpected figures, and complex situations are common in commercial television today as the competition for instant viewer attraction gets stiffer. However, skillful manipulation of the various dimensions of visual messages for the sole purpose of attracting the viewer's attention is in total contrast with the theories of communication, visual perception, and picture composition which suggest instead that compatability and balance of various elements of a message should be used as the means to achieve a meaningful and most effective communication (Baggaley, Ferguson, & Brooks, 1980).

An area of commercial television in which such theories of communication are ignored is the figure/ground relationship. It has been observed repeatedly that advertisers and commercial television producers present still and moving pictures in which the harmonious coexistence of the figure/ground unity has been disrupted. Such disruptions, it is suggested, cause apprehension while attracting the attention of viewers (Cerulo, 1988, p. 98).

Viewer's instant attention and perpetual apprehension due to unorthodox or unexpected visual displays does not guarantee viewer comprehension or retention of such displays. On the contrary, literature in visual perception and picture composition and visual, ethnographic, and cultural communication seem to suggest that unjustified distortions, abrupt interruptions, or unusual framing of figures in relation to their environment will diminish rather than enhance the degree of viewer understanding and retention.

Nevitt (1982), for example, suggests that "Nothing has any meaning except as a figure in relation to some ground" (p. 56) and stresses the need for the harmonious coexistence of the figures in relation to their backgrounds or contexts, regardless of how swiftly figures change to grounds and grounds become figures. Nevitt (1980) also recognizes that in the information society, which is filled with visible and invisible biases in media, constructors of visual images perpetually interchange, scrutinize, and disrupt the harmonious coexistence of the figure/ground relationships. According to Nevitt (1980), "The figure/ground relation is not fixed, but constantly changes as figures become grounds and vice-versa" (p. 17). These abrupt interchanges which professional communicators imposed upon us, according to Nevitt (1980). "...succeeded in creating an all-embarrassing environment of instant electronic information that is actually decreasing both human tolerance and mutual understanding in any human society" (p. 9).

Gibson (1979, p. 191) and Bloomer (1976, pp. 35-38) contend that ambiguity of the visual elements that constitute the figures as opposed to those which form the grounds present serious perceptual problems which inevitably hinder the normal process of visual communication. Gibson (1979, p. 43) underlines the importance of the environment--the background--as a contributing factor in understanding the figure in the foreground and emphasizes the role of the ecology in visual perception, a factor which is perpetually violated by advertisers and commercial television producers in their attempt to arouse viewers' apprehension and gain their instant attention.

Underlining the major figure/ground relationships, Bloomer (1976) states that:

> A figure is perceptualy bright, it is seen with more intensity and as standing out of the background... A figure also has the quality of being a thing and or being on top of the background. The ground also has specific characteristics: It seems to be behind the figure, to lack a particular form and to be continuous--that is, you do not perceive it as stopping at the edge of the figure but rather as going on behind the figure. A figure suggests meaning, while a ground seems relatively meaningless (p. 35).

Zettl (1973, pp. 130-133) and Metallinos (1979, pp. 205-214) both recognize the importance of the figure/ground relationship for the effective construction of television images. Outlining this importance, Zettl suggests that "television requires a clarification and intensification of the figure/ground separation rather than a camouflaging of it" (p. 133).

Kipper (1986, pp. 295-307) also stresses the importance of the presence of the environment in picture composition and suggests that the more information television viewers have of the surrounding--the background--the better their understanding, and consequently, their memory of the picture's content will be.

Sociologists such as Leach (1976) and ethnologists such as Garfinkel (1967) have pointed out that in any communication figure and ground are intimately related and culturally bonded together. Knowledge of the particular culture which produces the picture is a prerequisite for understanding the meaning conveyed in pictures. Once the relationships between the figure and the ground of pictures are socioculturally defined, they become very important dimensions of the communication process (Garfinkel, 1976, pp. 40-45).

The important issue and the key question of this exploratory study is whether purposeful disruptions and anomalies in the harmonious coexistence of the figure/ground relationship in still pictures and commercial television images will diminish rather than enhance viewer's total comprehension and long-term memory of these visuals. Empirical research in the fields of experimental, perceptual, and cognitive psychology, and in neurophysiology and communication as well, seem to support the notion that confusion rather than understanding and a short rather than long-term memory span are the results of viewer inability to distinguish in pictures those elements that constitute their figures from those which identify their backgrounds.

In regards to message retention, for example, Rothkopf, Dixon, and Billington (1986, pp. 55-69) have shown that by augmenting and clearly revealing the spatial or environmental context of television pictures viewer's message retention greatly improves. Smith, Glenberg, and Bjork, (1978, pp. 460-471), have found that impoverished spatial context results in insufficient learning and poor memory and concluded that viewers retained information better when the spatial context--the background--was undisturbed. Gunter (1980) tested the memory span of television news viewers by utilizing the background of the pictures and found that "...news item recall can be effected by picture content..." (p. 127) and stressed the importance of background visual information in memory and recall of visual messages.

As far as comprehension and clear understanding of visual displays in general is concerned, Mearers (1980) tested the figure/ground brightness contrast and reading disabilities in children and found that the degree of comprehension and understanding of reading greatly depends on the "...conventional figure/ground organization books, i.e., black print on a white page" (p. 13). These findings suggest that any discrepancy or uncertainty in the figure/ground brightness contrast will result in confusion and misunderstanding of the written message. Welch and Watt (1982, pp. 133145) studied the degree of learning of pre-schoolers, which is seemingly related to comprehending and understanding, by using complex visual stimuli and found that visual attention and visual complexity are not isomorphic. They concluded that low to moderate levels of activity will enhance visual attention (Welch & Watt, 1982, p. 144).

The purpose of this diagnostic study was to address the question of whether or not figure/ground anomalies in still advertising pictures and television commercials effect viewers' total comprehension and retention of such images. Pictures containing figure/ground anomalies were defined as those still or moving images in which the aesthetic principle of figure/ground unity, as described in the review of literature, was violated thus producing unclear, unbalanced, incohesive, and confusing pictures. Since all of the pictures contain some information and give some degree of understanding of the event or object they depict, total comprehension was defined as the unquestionable and complete understanding of the content, both visual and auditory. Retention of visual messages was defined as the normal time required by the viewer to store the picture in his/her memory and then to retrieve and readily describe it.

The following research questions were set forth to be examined:

1. Viewers' total comprehension of still and moving images is differentially effected by the lack of clearly distinguishable figure/ground relationships.

2. Viewers' retention of still and moving images is differentially effected by the lack of clearly distinguishable figure/ground relationships.

It was expected that viewers' comprehension and retention of the visuals presented with the figure/ground anomalies would be diminished significantly.

Method

Stimulus Materials and Subjects

A total of ten pictures were selected from books referring to figure/ground relationships and also from various popular magazines and they were made into slides. Half of the slides were in color and the other half were black and white. All of the slides presented various discrepancies in the perceptual and the compositional unity of the figure/ground relationships.

In addition, two popular television commercials were selected for the tests, both of which contained various disorders in their figure/ground unity in order to shock or instantly attract viewer attention. The first was a 15-second Certs Breath Mint commercial which shows a futuristic, animated factory with a huge cylindrical machine in its center and animated miniature workers running aimlessly around. The second commercial was a 30-second ad of Alpha Romeo's new car called the Milano. The opening shot is of a parking lot with thousands of cars in long rows. It then dissolves into a shot which shows the bottom of the cars in the parking lot becoming the roof, or sky, from which the new car is lowered into a warehouse and then goes to a pseudo-environment with long road lights and power poles through which the car starts to move.

Aided by additional visual and auditory factors such as unexpected cuts, strange narration describing the action, and peculiar sounds, these fast-paced commercials were successful in apprehending the viewer and demanding instant attention to the visuals.

A total of 122 students from various university classes, evenly divided between men and women, were randomly selected to take the test.

Measures

Research in the fields of perceptual, experimental, and cognitive psychology as well as in visual communication has suggested that the memory of events involving visual stimuli are initially structured in the peripheral domain of the viewers (Brown, 1976; Mandler & Parker, 1976; Mandler, Seegmiller, & Day, 1976; Gibson, 1979; Jacoby & Craik, 1979; Kipper, 1983). According to Kipper (1983):

> The physical details of a scene are filled-in or "described" to the degree allowed by the observer's mental set and by the conditions of

> observation. When the observer later attempts to recall the event the quality of the initial description determines how well the event can be discriminated from other similar events (p. 300).

Both variables, the description of the visuals (their comprehension and and clear understanding) and their retention (the viewer's normal memory of them), were measured by two different measuring devices developed for this experiment. The first measurement consisted of a questionnaire of ten questions, one for each of the slides. Each question provided five choices with values ranging from five points (highest) to one point (lowest). This measurement was developed to gather data pertinent to the still pictures. The questions were equally divided between the variables comprehension (questions 1, 4, 5, 6, 7) and retention (questions 2, 3, 8, 9, 10). (A sample of the first test is in Appendix A).

The second measurement also consisted of a multiple-choice questionnaire of eight questions based on the two television commercials described earlier. This measure was developed to gather data referring to television images. The questions were divided between the variables comprehension (questions 1, 4, 6, 7), and retention (questions 2, 3, 5, 8). (A sample of the second test is in Appendix B).

Procedures

Since the viewing conditions and the experimental setting are crucial factors in the process of visual communication, an effort was made (a) to have the subjects sit approximately the same distance (8-10 feet) from the slide and television screens and (b) a small number of subjects (8-10 students) were tested each time.

Subjects of the first test were shown the slides in 15-second intervals allowing five seconds to see each slide and 10 seconds to register their responses. After the first test was over the subjects were instructed to carefully observe the two video commercials and to register their responses.

Analysis and Results

The purpose of this exploratory study was to diagnose the extent to which still pictures or television images, lacking proper figure/ground relationships in their composition, are easily comprehended and recalled by viewers. It was hypothesized that viewers' total comprehension and retention would be significantly effected by the lack of clearly distinguishable figure/ground relationships in specially selected still and moving images. (Table 1 shows the sum-total of the responses to each variable).

Since this was only an exploratory study lacking the customary control group, the statistic used was a simple calculation of the sum-total of all scores ($\sum_{i=1}^{N} x_i$ or Σx where N=122) for the factors comprehension and recall. The preliminary analysis was based on the percentage (%) of the average scores of each question.

Table 1

Total Responses of the Factors Comprehension and Retention

First Test (Slide Visuals)			Second Test (TV Commercials)		
Comprehension	Total	% Correct (610)	Comprehension	Total	% Correct (610)
Question 1	568	.92	Question 1	307	.50
Question 4	331	.54	Question 4	319	.52
Question 5	210	.34	Question 6	355	.58
Question 6	498	.81	Question 7	228	.46
Question 7	342	.56			
Total		.63	Total		.51
Retention			Retention		
Question 2	283	.46	Question 2	311	.50
Question 3	510	.83	Question 3	366	.60
Question 8	480	.78	Question 5	232	.38
Question 9	502	.82	Question 8	341	.55
Question 10	527	.86			
Total		.73	Total		.50

The first slide, depicting a man sitting on a chair in front of a black background, was not understood or comprehended by the subjects. Ninety-two percent of the subjects responded that they did not understand the content of the picture. Slide #4 was Marc Chagall's painting titled "I and the Village," in which the figures become backgrounds and vice-versa, producing a complex and dynamic synthesis of figures within grounds requiring intensive observation and study of the details. Only 54% of the subjects were able to identify the actual background of the picture correctly. Slide #5 was a picture of a Dalmatian dog which blended totally with the black and white spots of the environment making its identification at first glance very difficult. Only 64% of the test subjects were able to identify the visual synthesis of the picture. Slide #6 shows a model standing in front of the apex of two white walls (five points). Subjects were asked to describe the background and although the degree of correct answers seems fairly high at 81%, most of the subjects chose one white wall (four points) which was the second best answer. The understanding of the important elements in slide #7 was an average 56% indicating that neither the over-all shape nor the colors of the picture were clearly comprehended by the viewers. The over-all degree of comprehension of the five slides was only 63% which suggests that comprehension of still pictures with figure/ground anomalies is fairly minimal.

The retention of slide #2 advertising the drink Tia Maria in the foreground and showing a woman's face in an exotic setting in its background was a fairly weak 46% since the subjects mainly remembered the colors or the woman's face in the background. The subjects' memory of the faces in slide #3 was fairly clear at 83% regardless of the confusion of their appearance. Recall of the visual elements of slide #8 depicting a large brown bear as the ground on which other bears, a helicopter, and two people are shown, was 78%--not particularly strong. Slide #9 which shows a picture within a picture--a house inside a bottle of liqueur--was fairly easily remembered by the subjects (82%). Slide #10 showing a drawing of a dog with only black and white areas was easily retained. The over-all degree of retention of the five slides was only 73% which suggests that retention of these still pictures with obvious figure/ground anomalies was somewhat effected.

The results of the second test--the television commercials--were significantly lower as shown in Table 1. The over-all degree of comprehension measured with questions #1 (50%), #4 (52%), #6 (58%), and #7 (46%) was very low (51%). In question #1 the subjects expressed difficulty in understanding the direction of the movements of the people in the background. In question #4 the subjects had great difficulty comprehending the action which took place in the background of the Certs commercial. In question #6, when subjects were asked to identify the activity in the Certs commercial, there seemed to be great confusion. Lastly, in question #7, the responses suggest that the visual materials used in the Alpha Romeo commercial were little understood.

The overall degree of viewer's retention as tested with questions #2 (50%), #3 (60%), #5 (38%), and #8 (55%) was only 50%, which is substantially low. In question #2 the background did not seem to attract the attention of the subjects as one might have expected. In question #3 the ranking of the visual elements in the Certs commercial in terms of their importance was incohesive. The approximate number of telephone or light poles along the road in the Alpha Romeo commercial in question #5 was very poorly identified. Lastly, in question #8, the subjects performed poorly in their effort to recall the background from which the Alpha Romeo Milano was lowered.

Discussions and Conclusions

Due to the lack of a control group, vigorous statistical treatment was not deemed necessary since this is an exploratory study intending to diagnose the consequences of figure/ground anomalies in viewer comprehension and recall.

The overall results seem to support the hypotheses that anomalies in the figure/ground relationship in still and moving images might attract viewers' instant attention but they are not completely comprehended or easily remembered. Consequently, the overall effectiveness of the visual communication process does not seem to be all that successful.

The suggestion by scholars such as Cerulo (1988) "...that disrupting conventional relationships among the elements of communication can actually enhance clarity and effectiveness" (p. 94) does not seem to be true. In fact, the review of literature and the preliminary findings of this study seem to suggest just the opposite. Further investigation and repeated tests on this issue are necessary.

There are a series of drawbacks also diagnosed by this study which should guide future researchers. First, the construction or the selection of visual stimuli in both still pictures and moving images, with an obvious lack of figure/ground harmony and clear distinction, must be made with a control group in mind. Second, the application of measuring devices utilizing the paper and pencil technique of data gathering is not such a reliable design for the study of visual communication related variables. More advanced, precise, and unbiased measuring devices such as the known psychophysiological instruments EEG, EKG, EMG, GSR, Eye-Tracking Camera, or pupilometer should be employed (Metallinos, 1987). Third, the subjects' long-term exposure to and familiarity with commercial pictures--still and moving pictures--must be firmly controlled if the results are to be valid. Lastly, the constructs comprehension and retention are unique, separate, and distinct human processes when each is found alone. As such, they are found in different parts of the human brain. However, where they are both present and they are measured in the same study, the interaction and intervention of one with the other is significantly enhanced. Measuring devices that will compensate for such interactions as retention, due to the clear understanding of visual displays, are warranted.

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Appendix A

First Test

Slides

Instructions

Listed below are a series of statements and questions referring to the slides you will see. Each statement and each question represents an opinion, your opinion. We are interested in finding out the extent to which you agree or disagree with each question or statement.

Usually, first impressions are the best in such cases, but your point of reference should always be the slides you will see. Read each question and each statement very carefully. Decide on your answer and check the appropriate appropriate response listed below each question.

Since time is a factor which might bias the study, please comply with the time restrictions determined by the study.

Thank you for your cooperation.

First Test

1. To what degree do you feel you understood the content of this picture?

1 Very well
2 Well
3 Adequately
4 Somewhat adequately
5 Not at all.

2. What attracted your attention the most in this picture?

1 The colors
2 The face in the background
3 The figures in the foreground
4 The lettering in the picture
5 The glass with the drink.

3. What are the five most important visual elements in this picture? (Please complete in terms of importance).

5 Faces
4 Black and white areas
3 Facial expressions
2 Overlapping pictures
1 Other.

4. Which, in your opinion, is the real background of this picture?

2 The little house on the top left side

3 The house in the bottom center
5 The head on the left side
1 The cow's head on the left side
4 The circle in the center.

5. To what degree do you understand the visual synthesis of this picture?

1 Very well
2 Well
3 Adequately
4 Somewhat adequately
5 Not at all.

6. Was this picture taken in front of:

4 A white wall?
1 A mirror?
5 Two white walls?
3 A white sheet?
2 None of the above.

7. What strikes you as the most important element in this picture?

5 The shape of the picture
4 The colors of the picture
3 The entire synthesis of the picture
2 The symbolism of the picture
1 None of the above.

8. List the elements existing in this picture in terms of importance?

5 Big bear
4 Two smaller bears
3 A helicopter
2 Two men
1 Other

9. Describe, in order of importance, what you saw in this picture.

5 Bottle of whiskey
4 The house within the bottle
3 Snow and lights
2 Trees and snowman
1 Other

10. How many black spots are there in this picture?

4 More than 10
5 More than 15
2 Less than 10
3 Less than 15
1 Do not remember.

Appendix B

Second Test

Television Commercials

Instructions

Listed below are a series of statements and questions referring to the videotape you will see. Each statement and each question represents an opinion--your opinion. We are interested in finding out the extent to which you agree or disagree with each question or statement.

Usually first impressions are the best in such cases but your point of reference should always be the video you will see. Read each question and each statement very carefully. Decide on your answer and check the appropriate response listed below each question. Since time is a factor which might bias bias the study, please comply with the time restrictions determined by the study.

Thank you for your cooperation.

Second Test

1. The people in the Certs commercial were going upwards towards the center of the picture.

   1 Strongly agree
   2 Agree
   3 Neutral
   4 Disagree
   5 Strongly disagree.

2. Your attention was drawn by the background of the pictures.

   1 Strongly agree
   2 Agree
   3 Undecided
   4 Disagree
   5 Strongly disagree.

3. Please list, in order of importance to you, at least five other elements visible in the Certs commercial.

   5 Bottle of whiskey
   4 Factory-type environment
   3 Snow and lights
   2 The colors of the picture
   1 Other

4. Please indicate what you understood best in the Certs commercial.

   4 The environment of the event

3 Certs importance on our health
2 The making of Certs
5 Certs' destruction by pressure
1 None of the above

5. How many telephone or light poles are shown along the road in the Alpha Romeo commercial?

3 Less than three
5 More than five
1 Do not remember
4 Only four
2 More than two.

6. Please indicate the degree to which you understood what the people in the Certs commercial were occupied with.

3 About 50%
1 About 10%
4 More than 60%
2 Less than 50%
5 About 100%.

7. The visual materials used in the Alpha Romeo commercial were clearly understood.

1 Strongly agree
2 Agree
3 Neutral
4 Disagree
5 Strongly disagree.

8. The car in the Alpha Romeo commercial fell from the roof of a huge warehouse.

5 Strongly agree
4 Agree
3 Neutral
2 Disagree
1 Strongly disagree.

Teaching Visual Literacy with Films and Video

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We all know that the human skill called visual literacy, is not new, going back in time to the hunter-fisher period of man's development. Early man left visual messages in cave paintings and "read" the earth, sea, and skies for survival in his environment. The history of art is also the history of visual communication. Before alphabetical writing there were pictures. With the development of the industrial societies, reading and writing verbal messages in the coding of language were the mainstays of education. The demands of the present post-industrial or "knowledge" society require that education combine generic "literacy" with other literacies--particularly in interpreting and finding meaning in the combination of visual and verbal responses to electronic messages which, unlike conventional printing, are fleeting and evanescent unless captured on tape or film. For maximum effectiveness in learning, visual literacy skills can be developed in the classroom.

It is how to use such visuals as video and film in classroom instruction that this presentation will deal with. It will concentrate on the questions affecting the use of educational films as an affective or cognitive learning tool, both to impart information and to create experiences for students. The presentation will deal with how to select a film for a particular lesson; how to prepare students for the film so that its relationships to the instructional objectives are clear, how to structure a lesson, including the language arts (vocabulary, grammar, writing exercises); how the student can be led to analysis of the form and structure of the medium in order to promote his/her visual literacy. The student must learn how to think about questions to ask in order to integrate the film experience into his/her other knowledge, feelings, or information. As a practical exercise for the audience, an example will be used--16 mm. film--with discussion and application of guidelines by the audience.

An anomaly in American education is that formal education begins with pictures related to language and concentrates largely on reading books or papers in school, whereas outside of school, children and young people are increasingly exposed to electronic media. Print stores information and messages for immediate reference. You can carry the resulting book with you in your pocket. The new electronic media store information on film or magnetic tape or disks. You can carry the tape about with you but it is useless unless you have a piece of equipment to give it life. There is little doubt in my mind about the superiority of the book in terms of portability and what it does to/for the reader in helping him store and integrate information in his mind, or to create an image in his mind, activating his brain to respond to words in mental images which are of his own making. We are told that he learns with the left hemisphere of the brain the sequencing of language or mathematical forms in reading words or doing mathematics. With the right hemisphere of the brain he creates images in response to visual stimuli or hears sounds in relationships of voices or music. Although he can refer to his printed book to refresh his memory of the meaning of words in print, he will develop other ways of retaining his mental images if he has some skills to do it. The fleeting electronic images can be "connected" to impressions from print and the two areas can then act to reinforce each other. The student communicates the meaning of the visual image most usually through language in which he tells or writes what the visual image means. To do so probably also fixes it in his memory. He is visually literate if he can "read" and interpret the meaning of visuals or non-print as he reads and interprets the language which is printed.

Such literacy increases if the student can also create visuals as he would writing. In the U.S. the television set is on for six and a half hours a day in the average household. A student in the secondary school has seen approximatly 120,000 commercials by the time he gets there. His mind is saturated with images from the tube. His attention span can become limited to a short time--fifteen minutes between commercials--or the half-hour program, and he may become passive and unanalytical. This is the anomaly--while he is looking at TV he is not practicing reading print. He is only practicing responding to non-print images, to pictures and their related sounds. Film and video are probably the predominant choice of many students over choosing reading or writing in the traditional sense. They are learning from electronic media which fleetingly capture their attention, and for the most part require little creative effort from the student. To retain the medium's information and develop student skills in visual literacy, teachers who use films or tapes can follow certain common sense procedures for reinforcing what the student sees.

First, there are certain assumptions we shall make about the learning experience of using film or video. Second, what I shall discuss seems elementary and self-evident; but in my experience with supervising teachers instructional films are often referred to as "movies", which implies use in a theater for entertainment or pleasure, and it is expected that student will automatically derive meaning from the visual experience. Not so. There are age-old principles of teaching with film or video just as there are with teaching from print. If my supervisory observation is an example of what goes on in classroom settings, films are used for reasons other than structured learning--passing time, entertainment, etc.

Hence, this review of basic guidelines for using the moving image to teach analytical thinking, a kind of thinking which starts with the teacher, who will plan and structure a lesson.

1. Decide where in your syllabus or lesson plan you will need to or can explain an idea better with film.

    The film must be related to the information or experience of the lesson. It should not be shown just to fill up time. It can be used to do several things.

    (1) It can explain graphically an idea and thus enhance or reinforce the basic purpose of the lesson. In this sense it is cognitive in its effect.

    (2) It can provide an affective experience about which the students may be expected to describe their reactions or their emotions in discussion and in some form of composition or writing, or in speaking.

    In this case, the questions the teacher asks should be questions which require analytical thinking and using standard rhetorical forms such as comparison and contrast, definition of an idea or problem, moving from cause to effect, making inferences, etc.

2. The teacher must preview the film before arriving at a final selection.

    a. What do you do when you preview the film? Watch it several times.

    b. Plan for the time the whole film experience will take. Look carefully and take notes about (1) the content, and (2) how it was filmed - e.g., the way it is divided into parts; how and why it uses color or black and white as these elements affect the producer's message. How is the camera work or how are the camera angles used - what effect(s) do they create?

    c. The work of the camera man is vital. The camera man is the master of our minds-- he can change the course of history. What he captures on the film or video creates the response the audience registers through what it sees. He can, for example, make or break a political candidate who is speaking on television. Students should be made aware of the cameraman's power, and the need for analyzing camera objectivity or subjectivity.

    d. The use of verbal language in the film or video is important. Perhaps the film is silent and uses no verbal language. "Why?" is the question to ask. Perhaps it needs no verbal language and speaks only through the visual, in which case one must be able to "read" the visual message--to be visually literate.

e. Perhaps it uses only music or other sounds but not verbal language. In that case, what kind of music is used and why? (Martial, soft, symphonic, romantic, etc.)

These factors should be discussed with students before and during the discussion period. They can form the basis for a writing exercise.

3. Third, the teacher should prepare a printed lesson which can be handed to students to take away with them. The nature of the lesson will depend on the syllabus into which the film must fit. It should cover cogent points relating to the instructional objective.

4. Prepare the students for the film experience.

a. Tell them why you selected this particular film/video.

b. Explain the vocabulary used in the film/video and acquaint them with words which may be new to them or which they will need to discuss the film.

c. Discuss with them what to look for. Have them take notes about what you say and what they see.

(1) How is the film composed? What are the parts and how are they related to each other? A visual can be related to a written composition--i.e., what was the introduction, the body, the conclusion? Can it be outlined to show the relationship of the parts?

(2) What is the "single effect"?

(3) Have the students look for the relationship of colors to the subject matter. Why does the producer use color in this way?

(4) If the film is in black and white, would it be more appropriate to the content or purpose to have it be in color? Or is black and white a medium with a purpose directly related to the content?

d. Direct the students to jot down notes on all of the topics in a, b, c above and have their notes ready for discussion.

e. Discuss the role of the film editor.

5. The fifth step is to show the film.

a. Show the film in its entirety first to capture the single effect.

b. Depending upon your objective the film can be reshown and stopped where you want to discuss a point--this is particularly true of informational material or of illustrating ideas in sports.

6. Discuss the film's content and composition.

    a. Use questions about this notion that you shared with the students before you showed the film.

    b. Discuss major ideas--especially if the film's use is affective.

    c. Ask the students how the film applies to or fits into the classwork and what real life applications they can see. This is important in giving meaning to the film and the use of the film. It is important to make connections with what is familiar to them.

7. Finally, follow up any loose ends in the discussion. Give a writing question or exercise to fix the film in the students' minds.

In the teaching of English as a Second Language at Montgomery College, Takoma Park, Maryland, visuals such as film and video are used extensively, along with print, on the assumption that left brain (print), right brain (non-print) research can be used to the student's advantage and enhance his/her achievement.

The question of whether to use film or video arises. Remember your purpose and the effect you want to create. Film is best, in my opinion, for those subjects in which you want to involve the audience in a personal way either affectively or cognitively; the size of the screen encloses a larger audience in an experience together which is quite different from that of video. The effect is simply not the same. Video is too closely related with what we experience in our living rooms and connected in students' minds with entertainment. Unlike film, it is not larger than life, and perhaps in some sense the relationship to the monitor may be intimate but colder than the relationship to a larger screen. We keep waiting for the commercials!

At a recent film festival where a video was shown, there were six monitors in the room to serve the size of the room and the audience. Not only was this distracting--the tendency was to glance from the monitor nearest you to the others--especially so since the colors on all six were unintentionally projected as being quite different from one another although all came from the same master. In another larger room where a large video projection screen was used, the images appeared unfocused and misty and the resolution was undesirable. We still have a long way to go before the total effect of video for most educational purposes will rival film.

The lesser cost is often cited--but, in my opinion, cost is related to the quality of the educational experience which is provided by film, and the objectives of the experience. But that is another topic we can discuss another time.

This presentation concentrated on the use of educational films as an affective or cognitive learning tool, both to impart information and to create experiences for students, on how to select a film for a particular lesson; how to prepare students for the film so that its relationships to the instructional objectives are clear; how to structure a lesson, including the language arts (vocabulary, grammar, writing exercises); how the student can be led to analysis of the form and structure of the medium in order to promote his/her visual literacy. The student must learn how to think about questions to ask himself/herself in order to integrate the film experience into his/her other knowledge, feelings, or information. As a practical exercise for the audience, we shall use examples with a 16 mm. film--with printed handouts and guidelines given to the audience.

The two films shown for film discussion were the black and white Diving Sequence from the Berlin Olympiad in 1936, over fifty years ago, and still stunning. The film is archived at the Museum of Modern Art in New York. The other film was Ballet Robotique, a brilliant eight-minute color film (or video) made by Bob Rogers and Company, in 1982. It has won seventeen awards including a Golden Eagle and an Academy award for live action short film. Its genius lies in synchronizing the movements of robots with Royal Philharmonic ballet music from Bizet, Tschaikovsky, and Delibes. There is no narration in either film and students declare them fascinating. Ballet is available from Pyramid Films in Santa Monica, California.

Ideas in the Mail: Visual Propaganda in Postage Stamps

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When most of us think of propaganda, we think of overt and often negative attempts to change attitudes and behaviors. We think of advertising, political pamphlets, or revolutionary and seditious literature. Propaganda, however, can be more "establishment" oriented and distributed through the official channels of communication in traditional western democratic societies. The former style of propaganda is called "agitation" propaganda by Jacques Ellul (1965) while the latter is called "integration" propaganda. Integration propaganda is often unrecognized because it originates from non-propagandistic sources and is subtle and omnipresent.

One universal form of integration propaganda is the postage stamp. All nations issue postage stamps, and the collecting of stamps is a worldwide hobby. We lick them and think nothing of what we are saying with the little rectangles that we put in the upper right hand corner of the envelope. In this presentation, we look at the images of the postage stamp in terms of propaganda messages and the implications of postal propaganda in the study of visual literacy.[1]

Development of Postage Stamps

The origin of postage stamps can be traced back as far as 3800 B.C., to the cities of Babylonia and Assyria where a system to convey personal messages between nobility began. The messages were written in cuneiform on clay tablets and carried by runners to their destination. Each tablet was "stamped" with a cylinder seal that verified it as coming from the sender.

The concept of providing a system for sending messages continued to develop until in 1464 King Louis XI of France established the first national postal system. It was a success, but because of its high cost, its use was limited primarily to the upper class. By the 1500's, the use of postmarks indicating the price paid to use the mail service had developed. Most mail, however, was paid for by the recipient of the letter rather than the sender. It was not until the 1660's that prepaid mail became popular and with it the practice of stamping the date and location of the posting center on the envelope.

Prices remained too steep for the average person to make use of the mails until the postal reforms of the 1800's, first in England and then in the United States. The reforms also brought a significant increase in the volume of mail and the practice of hand-stamping each item became impractical so in 1840 England commissioned the first self-adhesive, separate stamps for its mail system. The famous Penny Black stamp with the profile of Queen Victoria was the first true modern stamp issued. In 1847 a private firm in the United States introduced postage stamps in New York. Colors were soon introduced and the stamp began to be printed as an object that served not only a utilitarian function but also an aesthetic and propagandistic function.

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[1] This paper was a visual presentation with slides of a wide range of different postage stamps. With only a little observation, however, the reader will be able to identify stamps that fit all the categories described in the paper even without the visual images.

In 1876 the first commemorative stamps were issued depicting the signing of the Declaration of Independence. Today the collecting of stamps is a major economic hobby around the world (Angus, 1973; Marzulla, 1974; Mackay, 1976). In the United States, the Citizen's Stamp Advisory Committee made up of fourteen men and women selects about 40 designs each year from the 1500 suggestions received from people representing all walks of life, grade school children to organized lobby groups (Kagan, 1988).

Stamps as Propaganda

Almost every government as well as the United Nations issues stamps to pay for its postal system. Governments go to great lengths to produce beautiful stamps. Stamps provide an interesting opportunity to implant an idea or image that can be quickly and pervasively broadcast throughout a nation or around the world.

Consider the typical stamp. It is a small rectangle of printed paper that may contain information as sparse as the name of a nation and the cost of the stamp. Most stamps, however, also contain a visual image. That small image is placed before a very large segment of the population. What can be done with so small a visual image? Quite clearly, a government can use it to present a message intended to influence public opinion.

An examination of postage stamps suggests several basic categories into which the visual images used on stamps can be categorized. These include: (1) beauty, (2) seasonal, (3) foreign appeal, (4) advertising, (5) national pride, (6) national achievement, and (7) heads of state. While there is some overlap in the categories, most stamps fit easily into one of these seven categories.

Beauty. Many nations print stamps that carry no message other than the natural beauty of the image. Often a striking piece of photography or art, beautiful scenes, flowers, animals, or similar images make a strong visual impression on the viewer. Beauty is a first prerequisite for a stamp to be a successful revenue generator. Color enhances the qualities that bring a stamp to the attention of the postal customer.

Seasonal. A popular subject for stamp artwork is seasonal holidays. Some of the most popular varieties of stamps are those issued each Christmas. They often contain a religious painting that is well known or the simple artwork suggestive of children and their part in the holiday. Watch your greeting cards next Christmas and see how many of them are stamped with the seasonal theme. In the Orient, the New Year is a major festival, and Japan produces colorful stamps honoring the celebration. Also popular are seasonal sports or sports events such as the Winter Olympics.

Foreign Appeal. A nation such as the United States is made up of a wide variety of ethnic groups, and each year stamps are printed that honor foreign events and appeal to various ethnic groups. A frequent image for such stamps is the portrait of a famous person. The United State thus issues stamps with Winston Churchill, Ghandi, and many well-known national heroes of since and history. Nations around the world issued stamps commemorating the first space exploration missions, both those of the United States and the Soviet Union.

Advertising. One of the primary functions of propaganda is the promotion of a service, item, or idea. Even postage stamps are not immune from such clearly commercial topics as the encouragement of letter-writing, stamp collection, and the postal service in action. Other public service topics include anti-drug messages, safety messages, and national and international health and relief organizations.

National Pride. Bolstering the sense of pride in ones nation is an admirable and worthy goal. Keeping the citizens of a nation in touch with the beauty, history, and ideology that have contributed to its development is a frequent theme of postal stamps. The United States, for example, often places messages about the rights and freedoms of its citizens on stamps. Other nations emphasize those aspects of their national heritage that appeal to public pride.

National Achievements. Closely related to national pride is the theme of national achievements. Famous athletes, scientists, inventors, and other national celebrities make popular visual images for stamps. The stamp provides a legitimate forum for national boasting. The anniversary of an important event is often depicted on a stamp including such events as the conquest of air and space, famous paintings, monuments, and regional topics.

Heads of State. Most nations print stamps with visual images of current or former heads of state. Some choose to place the image of the current head of state on all stamps (England), while others have clearly defined guidelines that prohibit the image of a living head of state from appearing on a stamp (United States). Other nations feature the image of a king, dictator, or religious leader.

Conclusion

It is clear that some propaganda value can be found in almost all stamps. This is not necessarily bad, but it raises the question of whether we recognize the potential for influencing public opinion without a knowledge of the influence. Do we believe what we see on our stamps? Do they help change our minds? Would you put a stamp on a letter that contained a visual message with which you disagreed?

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Visual Representations of Menu Items in Computer Systems

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Learning to use a computer can be difficult for many people. Part of the difficulty can be attributed to the type of communication that takes place between user and machine. Norman (1986) has proposed a model which describes the stages of user activities in a typical interactive computer session. Briefly, the user forms a goal relating to the task domain, which must be translated into a machine-related action specification. After the physical execution of this action, the user must interpret the result of the action, and then evaluate this result with respect to the original goal. The critical points of this interaction are the "gulf of execution", where the user's goal is translated into a system-specific intention and action, and the "gulf of evaluation", where the system's output is interpreted for evaluation with respect to the goal (Norman, 1986; p. 38).

Many different styles of computer interfaces have been developed with the goal of helping the user overcome difficulties in bridging the gulfs of execution and evaluation. The interface is the part of the computer system that handles communication between the user and the computer, and research has shown that the design of the interface is crucial for effective communication (Shneiderman, 1987). In fact, user satisfaction, productivity, and ultimately, sales of the software may be affected by the quality of the interface. Recent developments in direct manipulation interfaces attempt to alleviate many communication problems by employing windows, a mouse, pull-down menus and pictorial representations of objects. Working together, these components seem to improve human-computer interaction, but research has not yet established the separate contributions of each component to this improved communication. The goal of this study is to determine the efficacy of one of these components, the pictorial representation of information, typically utilized in direct manipulation interfaces.

Interface Styles and User Performance

Although the designers of the Xerox *Star* and Macintosh interfaces developed the systems based on psychological principles (Smith, Irby, Kimball, Verplank, & Harslem, 1982), little empirical evidence exists indicating that pictorial representations are more effective than verbal representations. Investigations of the *Star* interface were utilized to answer design questions, but did not specifically focus on the role of pictorial representations in the interface (Bewley, Roberts, Schroit, & Verplank, 1983). Muter and Mayson (1986) studied pictorial representation of menu items, finding that the addition of these representations to printed communication reduced error rates, but had no effect on response time. Their experiment did not actually test the computer interface, but focused instead on subject's responses to photographic slides of a computer screen.

In a comparison of seven different interactive systems, Whiteside, Jones, Levy, and Wixon (1985) found no appreciable differences in user performance between command, menu, and iconic interfaces. Their point that "a test of a system as a whole is more fair and valid than a decomposition into component variables" is well taken (Whiteside, Jones, Levy, & Wixon, p.

185). However, in order to isolate the effects of information representation styles, control of extraneous variables and experimental conditions needs to be more stringent.

In order to study the effects of interface style on user performance, an appropriate task must be chosen that is difficult enough to challenge users, but not overly complex. A menu selection task makes sufficient demands of the user, but does not require sophisticated understanding of computer systems. Shneiderman and Mayer (1979) suggest that users have syntactic knowledge about the device, such as which key to press for a specific action, as well as semantic knowledge about the task domain and about the computer. Menu selection, which can be viewed as a means to lessen the load on the user's semantic memory, has been investigated quite thoroughly. Menus allow the user to select from a list of system actions, rather than typing commands which must be retrieved from the user's memory. Several recent studies support the contentions of Shneiderman (1987) that performance on menu tasks is affected by menu length, organization, and selection method (Apperly & Field, 1985; Kaster & Widdel, 1985; Perlman, 1985). These experiments have focused on menus presenting information in a text format, but little research is available regarding other types of item representation in a menu selection task.

This study is designed to more clearly assess the role of one of these components, visual representation of information, in human-computer interaction. Specifically, the purpose of this study is to determine whether differences in user performance can be attributed to the style of human-computer interface, and if so, which interface style (text, pictorial, or text with pictorial) is the most effective in a menu selection task. The experiment is based on the predictions of the dual coding theory (Paivio, 1986), namely, that information presented in different formats is encoded in separate memory stores or systems. Paivio's basic premise is that pictorial stimuli are labeled on input and stored in separate imaginal and verbal systems. Words, however, are stored in only one system, unless they are high in imagery value. Burton and Bruning (1982) found evidence which suggests that this dual coding of pictures and words affects recall in both short-term and long-term memory. Because of the nature of demands on memory that is inherent in human-computer interaction, performance in a menu selection task should vary depending on the form of item representation for menu choices. Menu items presented in text or text with pictorial formats should produce better performance than items presented in a pictorial format.

Method

Participants and Design

Sixty one college students between the ages of 18 and 25 were randomly chosen from a pool of volunteers to participate in the experiment. Participants were randomly assigned to groups for the three treatment conditions of the experiment. In Condition One (Text Only group), participants were presented with menus that were one or two-word descriptions of the menu choices. In Condition Two (Pictorial Only group), menu choices were represented by pictorial icons based on the International Icons (Joyce, 1984). Condition Three (Text and Pictorial group) used the same icons as Condition Two, with the addition of the corresponding one or two-word descriptions from Condition One. In all conditions, information was displayed in a text format when the lowest of the four-level menu hierarchy had been reached.

Equipment and Instrumentation

The experiment was conducted at an office desk containing a Macintosh computer with ample room for operation of the mouse. Space was also provided on the desk for the answer sheets. The software was instrumented in order to collect data on the time and nature of the subject's choices. The software recorded the time taken to complete each selection and a code number indicating the item selected, and this data was stored on the system disk for subsequent retrieval and analysis.

Task

A problem solving task was designed which required participants to search a database in order to answer thirteen questions about the businesses and services of a fictional town. Menu selection was accomplished by the use of a mouse input device. As an item was selected, a new menu was displayed. Retreating from a low level to a higher level menu was accomplished by pointing the arrow at a box marked "Exit" at the bottom of the screen, and clicking the mouse button. Participants were informed that they were testing a new piece of software for its efficiency, and that speed and accuracy were of equal importance.

Procedure

The computer was turned on and the software prepared to run before each participant entered the room. A brief introduction to the computer system was given to the participant, and a short practice session in manipulating the mouse was provided (the software contained a special "practice" mode which was in operation at the beginning of each session). After the participant had sufficient practice with the mouse, the experimenter placed the computer in the experimental mode, and the participant proceeded with the task. The experimenter was available to answer any questions regarding the use of the mouse, but gave no information with respect to the interpretation of menu items or answers to the questions.

Results and Discussion

Table 1 presents a summary of the results for each of the dependent measures of performance: time per selection, total number of selections, average time for the first twenty selections, and average time for the last twenty selections (the latter two dependent measures were included as an indication of any familiarization with the system that might have taken place during the task). A one-way ANOVA procedure was used to examine the independent variable of interface style (Text Only, Pictorial Only, or Text with Pictorial). Results show significant differences for total time (F(2,58) = 6.13, $p < 0.0038$), total selections (F(2,58) = 8.5, $p < 0.0006$), time per selection (F(2,58) = 3.44, $p < 0.0388$), and average time for the first twenty selections (F(2,58) = 5.50, $p < 0.0065$). Average time for the last twenty selections was not significant (F(2,58) = 0.93, $p < 0.401$). This result may be due to the familiarization with the system which occurred for all participants, but especially for those in the Pictorial Only condition.

Table 1

Means and Standard Deviations for the Three Experimental Conditions

	Condition One Text Only Group (N=20)		Condition Two Pictorial Only Group (N=20)		Condition Three Text and Pictorial Group (N=21)	
Dependent Measure	Mean	SD	Mean	SD	Mean	SD
Time for Task (In Seconds)	575.20	222.62	948.78	495.48	733.78	228.54
Total Selections	92.65	13.34	113.50	25.97	92.90	13.20
Time per Selection (In Seconds)	6.15	1.98	8.13	3.03	8.09	3.06
Average Time (First 20 Selections)	7.36	3.06	12.28	6.36	10.89	4.52
Average Time (Last 20 Selections)	5.89	2.47	6.71	2.39	7.08	3.50

Comparisons of the means for each dependent measure were made using Duncan's Multiple Range Test (alpha = 0.05). These comparisons, summarized in Table 2, reveal significant differences in performance which can be attributed to the pictorial representation of information present in Condition Two, and in some cases Condition Three. These tests show that the pictorial representation affects the total time for the task, the total number of selections, the overall time per selection, and the average time for the first 20 selections.

Table 2

Results of Duncan's Multiple Range Tests for the Three Experimental Conditions

	Condition One Text Only Group (N=20)	Condition Three Text and Pictorial Group (N=21)	Condition Two Pictorial Only Group (N=20)
Dependent Measure	Mean	Mean	Mean
Time for Task	575.20*	733.78	948.78*
Total Selections	92.65	92.90	113.50*
Time per Selection	6.15*	8.09	8.13
Average Time (First 20 Selections)	7.36*	10.89	12.28
Average Time (Last 20 Selections)	5.89	7.08	6.71

(*Significant differences at the 0.05 level, underlining denotes no significant difference)

The results of this experiment confirm the hypothesis that pictorial information in a menu selection task adversely affects user performance. This finding is consistent with other studies which have tested the dual coding hypothesis in different memory tasks (Burton & Bruning, 1982; Paivio, 1986). When only pictures are used to represent information in a menu, the pictures are labeled according to a "best guess" as to their meaning. This "guess" is then either confirmed or denied when the next menu screen is displayed. The data, combined with experimenter observations of the sessions, indicate that participants in the Pictorial Only condition were "guessing" with respect to the meaning of each menu item more often than participants in the other groups. In addition, the longer time per selection and the greater number of selections for the Pictorial Only group support the notion that this labeling is more inefficient when the pictures are abstract, as is the case with the items in the main menu. The improvement in performance from the first twenty selections to the last twenty selections is an indication of familiarity with the task, as well as confirming that the meaning of the pictorial representations had developed from the beginning to the end of the task.

It is conceivable that participants used the pictorial representations as cues to develop hypotheses about which menu item corresponded to the category of the question. This cue selection process should take more time for pictorial items than for text items, because participants are more familiar with the written labels than the pictures. Table 3 summarizes the results of analyzing the total time spent at each level of the menu hierarchy. A one-way ANOVA revealed significant differences for the main menu ($F(2,58) = 3.92$, $p < 0.025$) and menus at the second level of the hierarchy ($F(2,58) = 4.32$, $p < 0.0178$). Time spent considering choices at the third level of the hierarchy was not significantly different for the three groups ($F(2,58) = 1.04$, $p < 0.3598$). As expected, Duncan's Multiple Range Tests show significant differences between selection times for Text Only and the other two pictorial conditions (See Table 4).

Table 3

Means and Standard Deviations for the Total Time (In Seconds) at Each Menu Level

	Condition One Text Only Group (N=20)		Condition Two Pictorial Only Group (N=20)		Condition Three Text and Pictorial Group (N=21)	
Dependent Measure	Mean	SD	Mean	SD	Mean	SD
Level One (Main Menu)	165.55	161.92	261.67	165.04	287.6	105.87
Level Two	174.36	63.63	257.02	119.32	238.92	89.62
Level Three	182.83	65.22	225.95	123.43	207.27	86.92

Table 4

Results of Duncan's Multiple Range Tests for the Total Time (In Seconds) at Each Menu Level

	Condition One Text Only Group (n=20)	Condition Two Pictorial Only Group (n=20)	Condition Three Text and Pictorial Group (n=21)
Dependent Measure	Mean	Mean	Mean
Level One (Main Menu)	165.55*	261.67	287.6*
Second Level	174.36*	257.02	238.92
Third Level	182.83	225.95	207.27

(*Significant differences at the 0.05 level, underlining denotes no significant difference)

The similarities in performance for Text Only and Text with Pictorial groups also supports the hypothesis that text representations are more efficient for this task. This is probably due to the participants' prior experience with the words used to describe menu items. In the case of the Text with Pictorial group (Condition 3), participants may have used the text as a cue while ignoring the pictures. But the opposite is also possible, since the time per selection for the Text with Pictorial group was not significantly different from the Pictorial Only group.

Conclusions

The findings of this experiment differ from those of Muter and Mayson (1986), perhaps because their experiment utilized photographic slides instead of computer graphics, or because their task did not employ a hierarchical menu structure. Specifically, they found that the addition of pictorial representations to printed menus did not increase response time for menu selections. Since their study did not actually employ computer interaction, further comparisons are not possible. This experiment, however, extends the results of Muter and Mayson (1986) to specifically apply to human-computer interaction while controlling for possible confounding variables such as input devices or command styles which were not controlled in the Whiteside, Jones, Levy, and Wixon (1985) study.

These results suggest that pictorial representations of menu items are not efficient due to problems in interpreting the meaning of the pictures. This is not to say that pictorial representations should not be used in constructing menus. Since there is so little difference in Text Only and Text with Pictorial groups, there is little reason to eliminate pictorial enhancement of menu items, other than the practical considerations of development time and cost for graphics. In addition, this study did not address the possible savings in relearning which may occur in using pictorial representations for menu items. It is possible that on subsequent interactions with the system, participants in the Pictorial Only group would show equal or better performance than the participants in the other groups.

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Toward a Still-Motion Theory for Multi-Image Production

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Background:

During the past ten years multi-image has provided an unforgettable impression as a medium to motivate, particularly when used by the top Fortune 500 companies. However, the principles that support the production of visual imaging, the programming cues to animate and the mixing of over-projection to create new lines of perception, are much older than ten years. In fact, the visual theories concerned with multi-image production can be traced back at least twenty-five years for television directing styles and even further for photography imaging principles.

Need:

The producer-director of the multi-image program needs more than a casual understanding of the traditional image design principles borrowed from film and television. The producer must apply a fresh combination of still-motion principles to effectively communicate the multi-image formulated message. Collectively these same principles must be carefully orchestrated with the sound track to provide a predictable audience response.

Purpose:

This description suggests that several newer still-motion principles concerned with visual design are appropriate for teaching multi-image producers. Five sets of traditional design principles (from film and television) are borrowed, filtered and combined for this discussion. They are: (1) storyboard layout/design, (2) screen format design, placement of images within those formats, (3) image design principles concerned with aspect ratio and image format, (4) directing cues and commands, and (5) the effect of the environment (presentation site) on the audience.

For purposes of clarity only a few of the principles and related theories are discussed. A logical extension of these examples are available through other written sources by this author.

(1) Storyboard layout/design:

All three media formats (film, television and multi-image) work through the same step by step design imaging process. Each producer begins with a concept, a purpose and an audience defined. Then, the producer moves through the stages of outline, storyboard, script (with treatment and style considerations) and finally ends with the production of the soundtrack. The sequence of these imaging principles remains relatively the same for all three media.

There is, however, one major departure from the traditional storyboard format that is unique to multi-image. That departure is the storyboard cue sheet. Unlike cinema and video storyboards which contain (usually) a two column format (audio and visual information), the multi-image storyboard must add programming cues, projector assignments, screen activities, and a detailed elapsed time code.

For example:

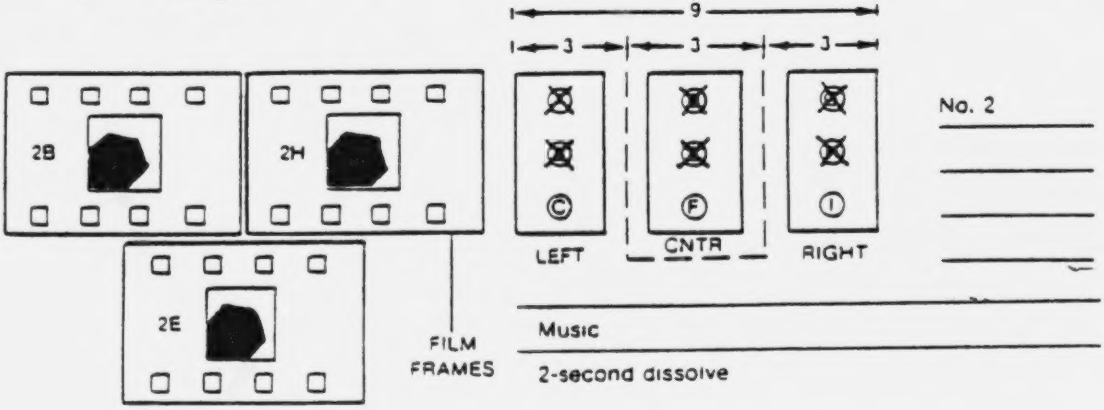

illustration 1
An AVL System Cues Printout

Storyboards for multi-image vary from program to program because of the number of projectors and screens assigned. Some directors prefer to work from detailed "boards" while others remand all programming details to the level of technology contained in their memory programmers.

These dedicated programmers (such as the AVL Roadrunner and Eagle systems) are often similar to a personal computer and allow the director to memorize successful cue patterns for each major cueing event. Following a few years of award winning "shows" a director may elect to print out program cues and times from the memory of the program disc. The result is an "after-the-fact" slick appearing storyboard complete with cues which may be given to the client. A similar practice is followed by advertising agencies when supplying their clients with after production imaging of a commercial.

(2) Screen Format Design:

Consider the traditional principles and theories for video screen format and aspect ratio. In television the screen format is defined as horizontal and not vertical. That is, all images appear wider than their height.

This horizontal format is further described as having an aspect ratio of three by four units. (For television this ratio conforms to the screen size.) For film or slides this aspect ratio is two by three units. Of course the projected images for both television and slide film remain in the same aspect ratio. These dimensions of format and aspect ratio remain the same no matter whether the images appear on your home television set or are projected onto a screen for larger audience viewing.

These two principles of design for screen format and aspect ratio are not the same for multi-image. Screen format may be vertical or horizontal (or even square). Even though a standard slide image ratio is two by three units, multi-image masking frequently alters this format. The technique of photographically editing the image or mechanically masking the image is an acceptable (and necessary) process for the producer of multi-image. Even the shape and size of the image within the screen dimensions may be altered to improve communication. Three examples of masking are shown in this illustration.

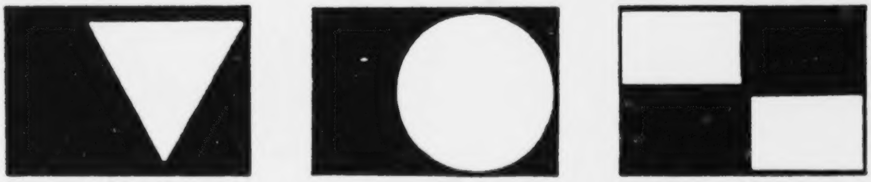

illustration 2
Popular Examples of Masking

In practice, an almost unlimited combination of screen formats and aspect ratio changes are available to the producer. The limitation of combinations is really bounded by the creative imagination of the MI producer. Unlike the fixed boundaries for film and television, the projected image for multi-image may be designed to fit an almost endless combination of screen arrangements.

The most popular image combinations are screen ratios of 3 on 1 and three 2:3. These ratios allow for split imaging in both the horizontal and vertical format as shown below.

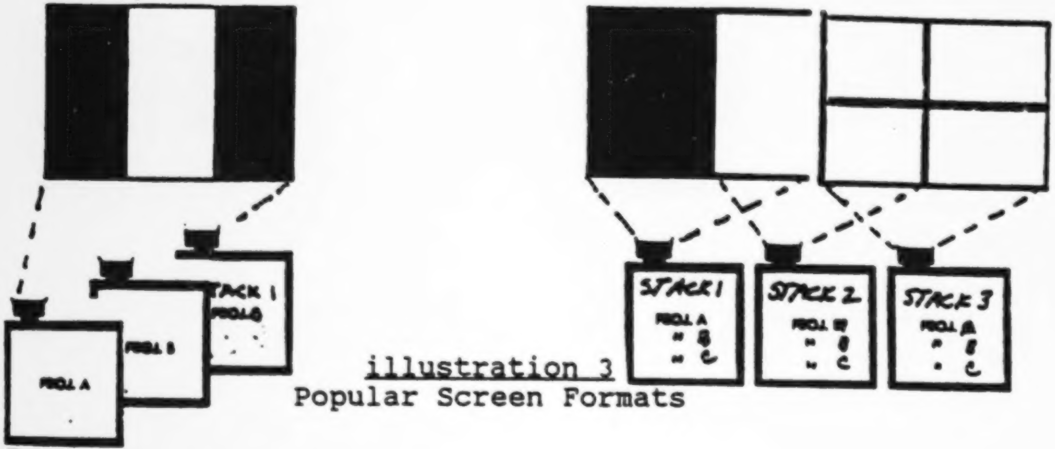

illustration 3
Popular Screen Formats

The point to remember concerning principles of design is that the dimensions of format and aspect ratio do not have to remain the same. The MI director selects screen size, shape and format (which often changes the aspect ratio). The resulting combination is supposed to support the desired visual message.

(3) Image Design:

What you see on the television screen (or the cinema screen) must always "fit" the aspect ratio pattern. However, slide images can be altered by the director either optically or mechanically to appear to have a new format. These images are shaped to fit the new screen shape or configuration. Portions of the screen may actually change shape as the images move around the screen area. Masking and creative photography (image design) is the answer to precise placement of images within designated areas.

The principles of visual design concerning image shape and placement (within the screen) is certainly not the same as in television and cinema. The higher the number of 35mm projectors involved in the program, the greater the possible combinations of new and varied screen formats available.

The producer of the multi-image program, therefore, must be cognizant of extended variables in visual design to affect a predetermined response. There are at least four specific and basic image design variables available:

(a) full frame (unedited) 35mm imaging,
(b) optical and mechanical masking,
(c) sequencing and animating across single and multiple projector assigned screen areas, and
(d) progressive disclosure or enclosure within the slide mount coupled with dissolves from projector to projector.

What is important to remember is that traditional principles of visual design still apply. Examples of these traditional rules are: use of color, contrast values, shape, size and style of lettering, image composition, focal point, informal and formal balance, use of line, perspective, and unity of image. These basic principles are to be followed and adapted to the fluid shapes of projected images.

The design principles are extended for multi-image, however, to include some new ideas. The producer must consider that screen format will affect individual slide design; and assignment of slides to a progression of projectors (which in turn are assigned screen areas) will affect design.

Thus, there are several additional visual design rules which must be considered. For example: how many masked slides arranged in a stepping series will provide a smooth illusion of flow-motion? Should the motion flow left to right, or diagonally to reinforce the message? Perhaps a zoom (illusion) in or out will be more appropriate. The function of designing these images is considerably different from television or film.

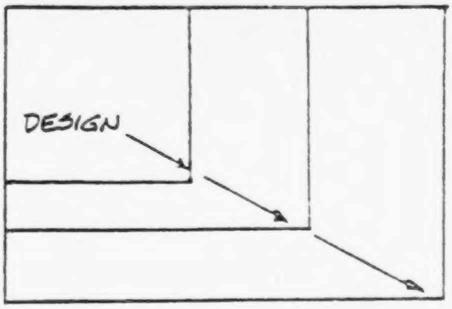

illustration 4
Storyboard Showing Image Progression
and Screen Assignment

(4) Directing Cues and Commands:

In this area of consideration, there is ample commonality of theory and practice within television, cinema and multi-image programming. A cut in all three media areas is defined the same: "an instantaneous change from one visual source to another." A dissolve is uniformly defined as a "gradual change from one visual source to another." And a fade is also a shared definition: "moving from black to an image" (or the reverse).

For the multi-image producer, however, a wide range of additional cues or commands are necessary and available. These cues are generally distinctive to multi-image. They include "field" or process commands as well as the visual activity cues. For example:

ENTER UNDER CODE HEADING	
AT	ALTERNATE
FA	FAST ALTERNATE
1A	1 SECOND ALTERNATE
2A	2 SECOND ALTERNATE
3A	3 SECOND ALTERNATE
4A	4 SECOND ALTERNATE
6A	6 SECOND ALTERNATE
8A	8 SECOND ALTERNATE
16A	16 SECOND ALTERNATE
32A	32 SECOND ALTERNATE
CT	CUT
HC	HARD CUT
1D	1 SECOND DISSOLVE
AX	AUXILIARY FOR DISSOLVES
BG	BLINK GO
BS	BLINK STOP
FZ	FREEZE
HOME	PROGRAMMABLE HOME
LD–	PROGRAMMABLE LOAD FILE xx
LG	LOOP GO
LL	LOAD LOOP
LS	LOOP STOP
N	NO OPERATION
PF	PROJECTOR FORWARD
SG	SMOOTH GO
SS	SMOOTH STOP
TBxx	TABxx
TMxx	TIME IN 01 SECOND STEPS
TX	TIME X (TO BE RESOLVED
W.05-W10	WAIT IN 05 SECOND STEPS
WX	WAIT X (TO BE RESOLVED
ENTER UNDER SCREEN HEADING	
G	GO
S	STOP
P	PROCEED
12345	SCREEN NUMBERS

illustration 5

A Selection of Cues and Commands for the
AVL Roadrunner MI Programmer

A departure from the traditional cues and commands is evident, and forces an extension of theoretical design understanding. Consider the following three examples of "new" commands with their applied definitions:

(1) a hard cut - faster than the standard cut, where the projector douser plate drops in front of the bulb;
(2) the flash - a repeated on/off action of one or more projector bulbs creating a short term image,
(3) the cycling animating - a given number of projectors are commanded to rotate at an assigned rate, and to repeat that cycle until cued to stop.

The list of commands for cueing grows to more than one hundred for many programming systems. This variety is considerably more extensive than the traditional definitions offered to the television director in directing theory. The MI producer must determine the cue activity, the time assigned to the cue, and the "wait" (if any) that will occur between cues. And, these decisions are usually very precise -- to a tenth of a second.

Another significant difference between television (and cinema) and the multi-image cueing, is the availability of leisure time programming. Simply defined, leisure time programming allows the programmer to select cues and times, entering them into the memory of the computer. The programmer may pause to think about these entries because the computer will store the cues and wait for a "run" command.

In television segments of a program may be recorded and then edited segment by segment. In multi-image "real time" programming is not necessary. The director may be selective about cues, store them, run them, and then edit each cue before re-running the sequence. So the traditional definitions of cueing the visual activity in multi-image takes on an extended definition. For me, the programming definition from theory to practice adds a fresh zest to the definition of "creative director."

(5) Environment Control and Design:

Environment is an unusual category to add to the changing definitions of visual design. The differences among television, film and multi-image audience environments is possibly a matter of degree rather than extensive substance. Television audiences for the most part accept the environment (in the home) and the programming schedule.

For multi-image audiences the event is usually staged in a carefully cultured environment. The audience attends the event because of a motivation to "see" the event. The room is designed to favor their comfort, but is controlled by the producer. The audience is usually introduced (prepped) for the event by a narrator.

Controlled environmental design does influence the audience's attitude toward the message. Many factors are important: heating, ventilation, variable lighting, seating comfort, audience positioning to the screen and the speaker (if used) and verbal cueing. All are utilized by the professional multi-image presentor.

Summary

Five areas of theory to practice have been explained relative to several principles of visual design. A comparison between more traditional design rules for television (or film) and the newer media field of multi-image has been offered.

The five areas compared were:

(1) storyboard layout/design, where extensive changes in board design were illustrated;

(2) screen format and image placement design, where the uniqueness of seeing the image creatively "placed" within a new frame of reference was shown;

(3) image design, where the image may be masked or optically "shaped" to fit the fluid screen placement;

(4) directing cues and commands, where an unlimited variety of new commands and cue definitions provide the director with the potential of unique creativity through selection, timing, pacing and sequencing of cues; and

(5) environment control and design, where the audience's attitude toward a program may be influenced favorably through careful preparation.

In multi-image, the "old" and the "newer" design principles must be collectively orchestrated carefully to provide the desired audience response.

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Using Filmstrips to Develop Reading Comprehension Skills

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Minor and Cafone (1977) proposed the use of a predictive model for directing students' interaction with 16mm film in a viewing-thinking process, which they called the Directed Viewing-Teaching Activity (DVTA). The DVTA applies prediction techniques, developed by Russell Stauffer (1985) in his Directed Reading-Thinking Activities model, to students' viewing activities. Minor and Cafone stated the following rationale:

> "to foster the development of an active meaning-gathering viewing attitude and corresponding viewing skills, and to increase the awareness of the learner of a viewing process. The teacher guides the viewers through the process until it becomes internalized and automatically employed in all viewing" (p. 20).

Stauffer's reading model employs predictive techniques, including developing hypotheses, gathering information to answer questions, evaluating hypotheses, and reformulating hypotheses on the basis of evidence. He suggests that the reading-thinking process begins in the mind and that predictive questions provide the directional and motivational impetus needed to develop reader independence. Adjusted for viewing rather than reading activities, the predictive model (DVTA) is:

I. Pupil action

    A. Predict
    B. View
    C. Prove

II. Teacher actions

    A. What do you think? (active thought)
    B. Why do you think so? (agitate thought)
    C. Prove it. (requires evidence)

No research to date has addressed the effectiveness of the Directed Viewing-Thinking Activities model. A research base does exist in which the effectiveness of the reading model has been investigated to determine if the approach is effective in developing comprehension skills. Is the model worthy of adaptation to the viewing process? The research available on the effectiveness of the Directed-Reading-Thinking Activity model suggests that utilization of predictive strategies is effective in increasing children's recall, comprehension, and critical thinking skills (Petre, 1971; Anderson, Mason, Shirey, 1984). Singer and Ruddell (1985) in their review of theoretical models and processes in reading instruction recommended prediction techniques, such as those employed in Stauffer's DRTA. Culver (1975) found that the DRTA was effective in improving elementary children's reading comprehension skills. Thus, a limited research base exists supporting the effectiveness of the reading predictive model in developing children's reading comprehension. The model is worthy of further research both in the areas of reading and in its adaptation to the viewing activities of children.

THE DVTA PROCESS

In the DVTA process, the teacher's role is to set purposes for viewing. Students make predictions and gather information to test their hypotheses. During this process it is important that the teacher accept all predictions as worthy, make no verbal judgments of responses, and ask questions designed to focus students' responses and to help them articulate their reasoning (Haggard, 1988).

In introducing the predictive model, utilization of slide or manually advanced filmstrip format will simplify the process. Students first view the title frame of the story. The teacher asks questions, such as "What do you think will happen in the story?" or "With a title like this, what do you think this story will be about?" Questions of this type will elicit a wide range of responses. The teacher serves as facilitator and accepts all predictions as valid. The class members view the first story frame. The teacher then asks questions, such as "What is happening in this picture?" Once a child has responded, the teacher questions, "Why do you say that?" or "Why do you think so?" The teacher should seek responses from the group by asking, "Does anyone else have an idea?" After discussion, the teacher asks, "Does anyone want to change his mind about what will happen in the story?" Those children who respond positively may be asked, "Why?" The students are then encouraged to hypothesize again about story content. This procedure can be repeated for each frame or for a selected sequence of frames. In this manner the children become active participants in problem solving and predictive activities. Skills developed in this simple application of the DVTA can then be transferred to other, more complex media.

WORDLESS PICTURE BOOKS IN THE DVTA

Wordless picture books, which tell a story, offer an excellent vehicle for visual literacy activities in a DVTA. Wordless picture books in filmstrip adaptation, produced locally or purchased through a commercial vendor, are especially useful since they can be shared easily with large groups of children. Wordless picture books have been used in elementary curricula in creative writing activities, as vehicles for developing children's abilities to make inferences about a story, and in promoting visual literacy. These books have also been used with older students in developing children's sense of story. In addition these books have been used as diagnostic tools to assess children's language and comprehension abilities and to assess children's ability to produce language. Hough (1987) used wordless picture books in a study where children were asked to tell an original story and to make up their own stories. She concluded that the opportunity to tell their own stories elicited the most elaborative language. Nurss (1981) used wordless picture books as a vehicle for analyzing four-year-old children's oral language skills. Jett-Simpson (1976) in a study using wordless picture books concluded that children's verbalized responses to inferential questions can reveal comprehension. Wells (1975) in a study combining visual literacy techniques and language experience using wordless picture books and nonnarrated films found significant growth in reading and in growth of language facility, both oral and written.

Use of the DVTA with filmstrips or slides adapted from carefully selected wordless picture books provides children with opportunities to hypothesize, make inferences, identify cause/effect, gather data, test hypotheses and rehypothesize. Wordless picture book filmstrip adaptations are especially good vehicles since usually there are no extraneous story frames. Each frame adds further information for processing as students predict what will happen in the story.

In selecting wordless picture books and filmstrip adaptations, teachers will need to evaluate the quality of both the story and the pictures. Some questions which might be asked are:

1. Is there a simple, linear storyline?
2. Is the plot interesting to and appropriate for the age group? Is it logical? Is it clearly told through the visual medium?
3. Are the pictures clear and of good quality?
4. Do the pictures tell the story? Does each frame add to story content?
5. Is the readability level of the pictures appropriate to the age group? Can the child piece together the elements in the individual frames to extract the meaning of the story?

6. Are the characters interesting? Do they engage and hold the viewer's attention? Do they do things consistent within the situation?

7. Are the settings intriguing? Are they appropriate to the characters and the plot the author has created?

For help in locating appropriate wordless picture books for visual literacy and DVLA activities, talk with your school library media specialist. Patricia Hutchins' wordless picture book, Changes, Changes, is a good example of a wordless picture book, which works well in a DVTA. The filmstrip adaptation is available from Weston Woods.

You may wish to employ other strategies as a follow-up to the DVTA. The following strategies are effective:

1. Have the children write their own stories, based upon the filmstrip used.

2. Have the children produce their own sequential stories without words, in a wordless picture book format. Exchange stories, and have another child use the peer produced book in a creative writing activity.

3. Analyze with the children visual elements, as the illustrator has used line, color, proportion, detail, and space in producing the story.

4. Discuss appropriate relationships in the story as sequence or cause/effect.

5. Have the children flowchart the events in the story or develop a concept map of the story.

The application of predictive techniques to student interaction with educational media is a promising tool for increasing students' comprehension. These predictive techniques should be employed in reading, listening, and viewing processes. Wordless picture books, adapted to some nonprint format, are good vehicles for visual literacy activities, including the DVTA and other visual literacy concepts. Materials, once purchased or produced, can be used to support a wide variety of learning activities in all aspects of the reading and language arts curriculum. Investigation of the effectiveness of the DVTA in developing children's ability to read pictures, develop a sequential story, recall and comprehend story content, and promote language development in children provides promising avenues for research.

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The Effects of Presentation Mode and Cognitive Style on Immediate Recall of Map Information

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INTRODUCTION

The consideration of individual differences among learners has become an important area of educational research. Among the individual differences that influence learning are cognitive style variables. Cognitive styles have been defined as modes of perceiving, organizing and processing stimuli. Cognitive style has to do with the *process* of learning rather than the *content*, with the "how" rather than the "what" of information processing. Cognitive styles are alike in that they tend to remain fairly stable over time, and that they tend to discriminate between simple and complex modes of structuring and among levels of differentiation and integration (Goldstein & Blackman, 1978).

The cognitive style which has been most strongly associated with learning and education is Witkin's field dependence-independence (Witkin, Dyk, Faterson, Goodenough, & Karp, 1962). Several investigators have reviewed and analyzed studies concerning field dependence-independence and learning (Goodenough, 1976; Witkin, Goodenough, & Cox, 1977), and have concluded that individuals who are characterized as field independent tend to be active learners, imposing order where needed, breaking up and restructuring when called for. In many learning situations an active approach is appropriate. Field dependent learners are seen as more global in perception, and more passive as learners. They tend to accept a field as given, to attend to noticeable features over relevant ones (particularly where there is conflict between saliency and relevance).

Although Witkin and his associates maintained that both orientations have adaptive value for learning, there is evidence to the contrary. Some researchers have found differences in short-term memory efficiency favoring the field independent orientation (Berger & Goldberger, 1979; Davis & Frank, 1979; Nahinsky, Morgan, & Oeschger, 1979). Robinson and Bennink found memory differences only when information load was high (1978).

There is a strong visual-spatial element in field dependence-independence (Goodenough & Karp; Linn & Kyllonen, 1981). It is usually measured by the Embedded Figures Test developed by Witkin and his associates, a perceptual test in which the subject must select a complex geometric figure from an embedding context.

The aspect of field dependence-independence that is tapped by the Embedded Figures Test has been researched and labeled as cognitive restructuring ability.

Differences between field dependents and independents in learning from visual material become most evident when the material is complex (having multiple spatial and conceptual relationships), with field independents better able to deal with complexity (Fleming, 1984; Wachtel, 1968). Coward and Lange (1979) concluded that field dependents can recognize and deal with existing organization as well as field independents, but are less able to impose structure. Designing or adapting complex visual instructional material to the characteristics of learners classified as field dependent or independent may increase learning effectiveness and prove useful in individualizing instruction (Ausburn & Ausburn, 1978; Heidt, 1977).

Use of Instructional Supports to Provide Organization and Reduce Complexity

Instructional supports are design devices which direct attention, emphasize, provide cues and give organizational assistance to the learner. Underlining, providing directional arrows, highlighting, and rearranging material spatially are examples of instructional supports. Many researchers have confirmed the usefulness of instructional supports (Allen, 1975; Clark, 1978; Dwyer, 1978; Fleming, Knowlton, Blain, Levie & Elerian, 1968; Fleming & Levie, 1978; Gagné, 1977; May 1965). However, there has not been a great deal of research done on the effects of sequencing and dividing information as a form of instructional support. Fleming and Levie have suggested that by "appropriate spatial arranging or temporal grouping, processing demands may be diminished" (1978, p. 56). Winn also advocated "the use of visual forms that express semantic and logical relationships spatially through layout" (1982, p. 13).

One study reported that reducing step size in a programmed learning task improved performance for field dependent students (Schwen, 1970). Another, by Jennings and Dwyer (1985), increased the number of visuals in a presentation, but conveyed the same amount of information overall, thus decreasing the amount in each visual. This manipulation was significantly more effective during immediate recall only. Cognitive style as a variable was not considered here.

Other manipulations which might be classified under instructional support as means of helping the learner deal with complexity include removing background and its distracting elements and limiting the amount of detail given. According to Dwyer, however, "the process of reducing detail may also unintentionally eliminate detail which would have been considered as primary learning cues for some learners" (1978, p.158). Two studies which examined this process (known as *compression*) and field dependence, found the technique of more benefit to field independents than field dependents (Dickie,1970; Hessler, 1973). Field dependents do not seem to benefit from less information *per se*.

Learning from Maps

A map is a complex combination of visual and verbal cues. MacEachern defined complexity in maps as "the degree to which the combination of map elements results in a pattern that appears to be intricate or involved" (1982, p. 32). There are various ways one might study a map: directionally (north, south, east, west), by comparing elements which are close to one another, by categorizing elements, and through an overall mental integration (Shimron, 1978). The processing of map-like information has been characterized as parallel rather than sequential (Paivio, 1970); however, Shaha (1982) reasoned that there must be some breaking down of the information into sub-groupings for learning and recall, although the image may be stored intact in memory.

Stasz and Thorndike (1979) identified several map sampling heuristics: 1) attentional (focusing on certain aspects, limiting the attention); 2) encoding; and 3) control: handling competing encoding and attentional heuristics. They found that successful map learners tended to use systematic procedures such as pattern and relation encoding (poor learners often could not recall their strategies).

Stasz and Thorndike also looked at the relationship of field dependence-independence to map learning (1980). They suggested that field dependents might be overwhelmed by the visual complexity and randomly study a map, rather than employing strategies to make the task manageable. The results of their map-learning experiment supported this idea in that field independents outperformed field dependents. While Stasz and Thorndike did not attempt any alteration of the instructional material so that field dependent performance might match that of field independents, the successful strategies employed suggest a manipulation of the maps whereby smaller amounts of information would be presented at one time to reduce information load and to offer fewer competing cues. Additionally, an externally devised organization and a link to context should be provided as an aid in structuring.

Description of Study

Based on evidence that field independent learners deal more successfully than field dependent ones with complex visual information, this study involved designing map presentations that would match the learning characteristics of each orientation. Experimenter-designed maps were manipulated so that information from one visual was divided and sequenced into a series of visuals, composed of precisely the same placement and relationship of elements. There was no simplification or condensation of the information. The aim of the sequencing was to maintain a clear organizational pattern, in order to direct attending and processing by the learner, yet to offer a more manageable amount of information at one time.

Three primary questions were addressed by this study:

1. Does dividing and sequencing information contained in a complex visual provide the learner with a more nearly optimal amount of information at one time, thus leading to improved performance on a visual learning task?

2. Do students who are classified as field dependent or field independent differ in performance on such a learning task?

3. Is there an interaction betwen design format and cognitive style?

METHOD

Design

A posttest-only 3 X 3 research design was employed. There were three presentation formats: *intact,* where the map was not altered in any way (this was considered to require the most active approach by the learner as it provided no externally dictated strategies); *additive sequential*, where the map information was divided by conceptual category (roads, cities, etc.) and sequenced in an additive manner; and *part-by-part sequential,* where each set of conceptually related elements was shown in turn, followed by the intact map as an organizational aid (see Figure 1). Subjects were divided into three levels of field dependence, based on scores from the GEFT (Group Embedded Figures Test). The dependent variable was immediate recall based on posttest scores, and independent variables were presentation format and cognitive style.

Subjects

Participants in the study were 92 undergraduate college students enrolled in audiovisual methods and educational psychology classes at Virginia Tech. Students signed up for a particular time to participate in the experiment, and then treatments were randomly assigned to these time periods.

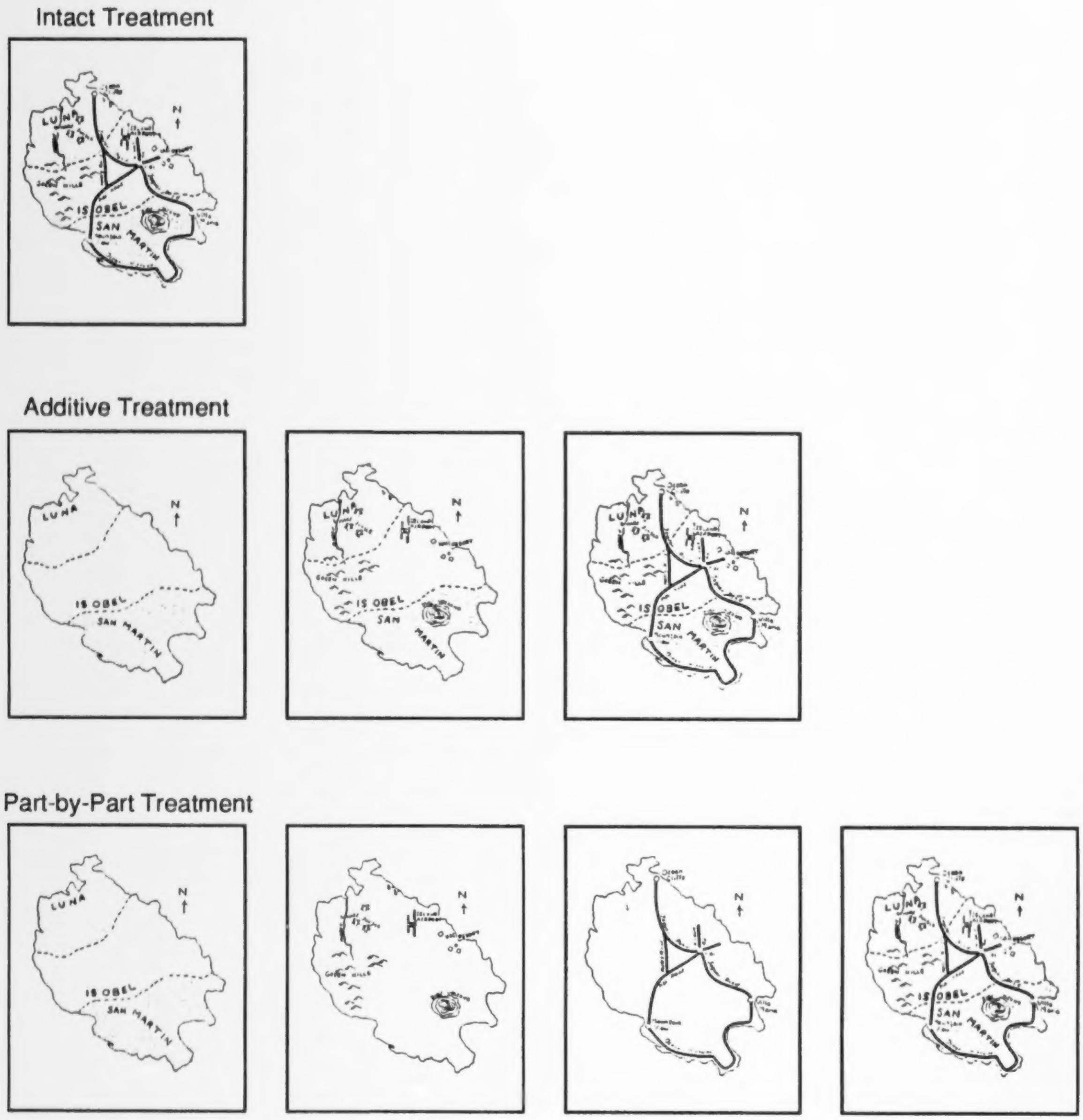
Materials

Materials used were map learning task booklets containing three maps, for each of the presentation formats; test booklets with a visual and verbal test for each map, also for each format; the Group Embedded Figures Test (Witkin, Oltman, Raskin, & Karp, 1971); and a personal data sheet. Paper copies of the map learning booklet and the test booklet were used to allow equal visibility and legibility for all participants, and to allow mixing the order of the maps within each treatment group.

Procedure

First, students were administered the Group Embedded Figures Test. Then samples of the map and the test were shown to the group and discussed. The students studied the three maps of fictitious locations and were asked to learn them as completely as possible in a time limit of three minutes per map. (The time was divided in the sequenced treatments.) The overall objective was that the student would be able to reproduce each map mentally.

After each map was studied, students were given the posttest on that map. The posttest consisted of a ten-question written and a ten-question visual section for each map (total of 60 questions). The written test was multiple choice, consisting of questions about locations, names, spatial relationships, and application of map knowledge. Each question in the visual section was made up of a set of five small map portions, of which only one was correct.



Intact Treatment

Additive Treatment

Part-by-Part Treatment

LUNA
ISOBEL
SAN MARTIN
N

Figure 1: Map Presentation Formats

After completing the experiment, students were asked to fill out the personal data form which included questions about age, academic major, SAT scores, and other demographic data, as well as asked to describe strategies they had employed in learning the maps. Data analysis was by a two-way analysis of variance using the least squares regression method (unequal cell sizes). Probability level for all tests was set at .05.

RESULTS

Mean posttest scores for the three treatments did not differ significantly. Mean scores were highest for the sequential additive treatment (41.28). There was a significant difference for cognitive style, $F(4, 83) = 4.64$, $p < .05$, indicating an association between higher posttest performance and a more field independent orientation. There was no interaction found between design format and field dependence-independence. In addition to the primary analyses, students were asked to self-report on strategies they had employed for learning the maps. 42 of the 92 responded. For all groups mean scores were higher for those responding. Those who scored in the field independent range on the GEFT were twice as likely to respond as those in the low (field dependent) category. Almost two-thirds of those in the intact treatment reported, whereas for the additive treatment only about one-third responded.

DISCUSSION

Results indicated that field independent learners were more adept overall at learning map information regardless of presentation format. The difference in mean scores, however, was most evident for the additive sequential treatment. There was a trend for the field dependents to score higher following the sequential treatments, but it was not significant. In spite of the effort to reduce information load, the level of complexity may have still been too great for the field dependent students.

	Treatment		
Level of Field Dependence	Intact	Additive	Part-by-Part
Field Dependent			
M	34.40	37.29	37.30
SD	9.94	7.79	10.18
n	5	14	10
Moderately Field Dependent			
M	42.00	43.50	40.00
SD	6.08	5.93	4.43
n	14	10	6
Field Independent			
M	41.27	44.08	39.80
SD	7.68	6.37	7.55
n	11	12	10

Note: maximum score = 60

Table 1: Cell means: Posttest Scores by Field Dependence Level

How to divide information optimally for individual learners is an important consideration that has not been thoroughly resolved. The results of this study indicate that cognitive style indeed plays a role in learning from visuals, and that designers should consider such variables as cognitive style when planning learning experiences involving complex visual material.

Perhaps alternatives to manipulation of such material might produce better results; for example, training in strategy selection might be worthwhile. Newer technologies such as interactive video make student selection of alternative learning strategies easier to provide for. As Messick (1984, p.69) stated, "We might thereby increase the student's strategic repertoire and the likelihood that strategies, even stylistically uncongenial ones, will be selectively and appropriately applied as a function of varied task assignments."

Source	*df*	*SS*	*MS*	*F*	*D*
Field Dependence Level	2	509.87	254.94	4.64	.012
Treatment	2	128.52	64.26	1.17	.316
Interaction of Field Dependence Level by Treatment	4	78.90	19.73	.36	.837
Error	83	4561.36	54.96		
Total	91	5280.55	58.03		

Table 2: Summary ANOVA

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Visual Literacy in Media and Technology Texts : A Content Analysis with Implications for Teacher Education

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In their work, Visual Literacy: A Way to Learn — A Way to Teach, Fransecky and Debes emphasize that "all teachers, on all levels, must be concerned about a pupil's ability to generate and process language, so that he may speak or write effectively and develop a better base for thinking" (p. 11). Educators traditionally have consented that all teachers, regardless of their subject matter expertise, should be prepared to assist students in mastering basic skills of communication — namely, reading and writing verbal messages. Yet Fransecky and Debes indicate that students must also learn to read and write using a visual language as well as a verbal one in order to be considered literate members of today's society. Therefore, teachers, again on all levels and in all subject areas, must be able to guide and monitor the development of their students' visual literacy abilities just as they oversee the development of students' verbal communication skills.

Teachers, however, may feel ill-prepared to assume responsibility for any type of visual awareness on the part of their students. Teacher education programs require prospective teachers to be able to communicate verbally. But many practicing and pre-service teachers have no experience with visual communication skills, nor have they had an opportunity to include visual literacy experiences in their program of study. Although some institutions offer courses in visual literacy for educators, many students still are unable to include such a course in their degree programs. If teachers are expected to help students develop visual literacy skills, teachers themselves must be given some practice and preparation for doing so. The traditional association of visual literacy with the field of educational communications and instructional technology may offer the opportunity for teachers to familiarize themselves with the concepts of visual literacy.

Rationale

The only exposure to visual literacy which many pre- and in-service teachers may receive is included as part of a "general media and technology" course. Though college instructors excercise a great deal of academic freedom in deciding which topics are included in a general media course, the textbook which is selected often serves as a guide to which issues are discussed during the course. And since general survey of media courses rarely afford time to study any one topic in depth, pre- and in-service teachers' knowledge of the field of visual literacy may be limited to the coverage the topic receives in the textbook.

Advocates of visual literacy should be aware of the extent and depth of coverage which visual literacy receives in current media and technology textbooks in order to select, and to help colleagues select, books which address visual literacy issues. The intent of this investigation was to analyze textbooks available for use in general media and technology courses and to ascertain a) how much exposure to visual literacy issues students would receive and b) to which topics students would be exposed if the particular text was used in class.

Procedures

Textbooks used in this study were selected from the Subject Guide to Books in Print, 1987-1988 and were published within the last ten years. Headings used to locate titles included "Educational Technology", "AV Materials", and "AV Education"; and only books which were determined to be targeted for a general educational media and technology course were used. For this reason, books about visual literacy were excluded, as were texts which focused primarily on media production or other specific topics.

The nine texts which were analyzed, listed in the annotated bibliography, produced a wide range of coverage of the topic of visual literacy. During the analysis of the coverage of visual literacy issues, four texts were found to list the term *visual literacy* in the table of contents, while five texts did not. In the indeces, *visual literacy* was listed as a referent in six of the texts, but did not appear in three books. It became apparent that merely quantifying data would not serve the purposes of this investigation and the research questions were refined into the following queries:

1. Would students using this text be provided with a basic definition of the term visual literacy ?
2. Would students using this text become aware of the visual literacy movement and its goals?
3. Would students using this text be provided with ideas for acvitities and practice in developing their visual literacy skills or the skills of their students?
4. Would students using this text be provided with additional resources for further learning about visual literacy?
5. Would students using this text be exposed to visual design and communication skills?

Comments in the accompanying annotated bibliography and information displayed in Table 1 address these questions and summarize the strengths and weaknesses of the texts in terms of their inclusion of visual literacy issues. All of the titles would

TABLE 1

ANALYSIS OF SELECTED MEDIA AND TECHNOLOGY TEXTS

	Would students using this text be provided with a basic definition of the term visual literacy?	Would students using this text become aware of the visual literacy movement and its goals?	Would students using this text be provided with ideas for activities and practice in developing their visual literacy skills or the skills of their students?	Would students using this text be provided with additional resources for further learning about visual literacy?	Would students using this text be exposed to visual design and communication skills?
Gerlach & Ely	No	No	No	No	No
Knirk & Gustafson	No	No	No	No	No
Sleeman et al.	No	No	No	No	Yes
Brown et al.	Yes	Marginal	Marginal	Yes	Yes
Haney & Ullmer	Yes	Yes	No	Yes	No
Locatis & Atkinson	Yes	Marginal	Yes	Yes	Yes
Wittich & Schuller	Yes	Yes	Yes	Yes	Marginal
Simonson & Volker	Yes	Marginal	Yes	Yes	Yes
Heinich et al.	Yes	Yes	Yes	Yes	Yes

serve well as texts for general media and technology courses, yet the books ranged greatly in their focus on visual literacy. The rank order list, arranged from those texts found to be least helpful in presenting visual literacy issues to those found to be most helpful and most inclusive, is offered from the perspective of an instructor who wishes to emphasize visual literacy and who desires affirmative responses to the five questions listed above.

Results: An Annotated Bibliography

Gerlach, V. S. , & Ely, D. P. (1980). Teaching and media: A systematic approach (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall.

Although Gerlach and Ely address many issues and ideas for using visual media in the classroom, concepts of visual literacy are not included in the text, nor are the basics of visual design and communication mentioned. An instructor selecting this text would not be able to answer any of the research questions with an affirmative and would need to supplement the text with a special unit on visual literacy if such a unit were desired.

Knirk, F. G. , & Gustafson, K. L. (1986). Instructional technology: A systematic approach to education. New York: Holt, Rinehart, and Winston.

Knirk and Gustafson emphasize the effects of different visual stimuli (i.e., motion, still, color, line drawings, photos, etc.), but do not discuss the elements of visual design. A prospective or in-service teacher using this book in a general media class would not be introduced to the tenents of visual literacy, visual education, or visual communication. The International Visual Literacy Association was not included in an appendix which listed professional organizations where readers could acquire additional information. Again, the five basic questions would be answered with negative resonses, and an instructor using this book would need to provide information about visual literacy outside the scope of the text.

Sleeman, P. J. , Cobun, T. C. , & Rockwell, D. M. (1979). Instructional media and technology: A guide to accountable learning systems. New York: Longman.

While not specifically addressing visual literacy issues, Sleeman, Cobun, and Rockwell include elements of visual design (simplicity, dominance, pattern, balance, variation, harmony, color, type, etc.) in their chapters entitled “Media Design,” “Media Production,” and “Media Packaging”. Students using this text would be acquainted with the elements of design but would not be exposed to more specific visual literacy issues, such as the need for visual education in the classroom.

Brown, J. W. , Lewis, R. B. , & Harcleroad, F. F. (1983). AV instruction: Technology, media, and methods (6th ed.). New York: McGraw-Hill.

One strong feature of this text is the inclusion of visual literacy fundamentals (layout and design), and the use of the term visual literacy when discussing still pictures and graphics. The "Skills of Visual Literacy" are listed as recognition of objects, identification of details, interpretation of visual cues, inference, arrangement, grouping, and sequencing. The book includes a helpful section on photography and bibliographic references are made to Debes, Dondis, Eastman Kodak, and other proponents of visual literacy. The text stops short of recognizing the visual literacy movement and its impact on education, but students using the text would be aware of the importance of visuals in learning. An instructor could supplement the information in the text to emphasize visual literacy issues.

Haney, J. B., & Ullmer, E. J. (1980). Educational communications and technology (3rd ed.). Dubuque, IA: Wm. C. Brown.

Although not listed in the table of contents, visual literacy is referred to as the "new literacy" and the beginnings of the visual literacy movement are discussed. Reference include Debes, Dwyer, Franskecky, and others, but the International Visual Literacy Association is not included in the list of professional organizations to contact for additional information. The text includes information about using visual media and the characteristics of visual media (color, motion, etc.), but guidelines for the design of visual media are not included. Students using this text would be introduced to a brief definition of visual literacy and the concepts behind the movement, but the instructor would need to supplement the book with information about visual design and communication, activities, and additional resources.

Locatis, C. N., & Atkinson, F. D. (1984). Media and technology for education and training. Columbus, OH: Charles E. Merrill.

"Visual literacy programs" is a term used in the index, but Locatis and Atkinson scatter information about visual literacy around several sections of the book. Lack of a coherent, cohesive section where visual literacy issues are addressed is the most frustrating aspect of this text. The book discusses aspects of visual literacy such as visual design and composition, visual perception, photographic media, and visual literacy programs, but the information is hard to find. References are made to Eastman Kodak, R. Ball, D. Pett, and the Association for Educational Communications and Technology, but the International Visual Literacy Association is not mentioned. An instructor using this text could pull the ideas and information presented in the book together and provide activities and additional resources.

Wittich, W. A. , & Schuller, C. F. (1979). Instructional technology: Its nature and use (6th ed.). New York: Harper & Row.

The shortcoming of the Wittich and Schuller text is that it is dated and the pictures reveal the age of the book. However, visual literacy is defined and the visual literacy movement is discussed. Topics include an overview of visual literacy, recent (to 1979) developments in visual literacy training, psychological reasons for visual literacy training, deterrents to visual sequencing, and goals of visual literacy training. Visual literacy programs in schools and the research of Lida Cochran are topics included in the book. The text also includes chapters on the characteristics and uses of various visual media and presents some elements of visual design, though not in depth. Strengths of the bookare the inclusion of specific activities to foster visual literacy and the extensive list of both print and non-print resources. An instructor using this text would want to supplement the design and layout sections (which are covered more thoroughly in the Student Production Guide which serves as a companion to the text). Students reading the text would have an introduction to basic concepts of visual literacy.

Simonson, M. R., & Volker, R. P. (1984). Media planning and production. Columbus, OH: Charles E. Merrill.

In a chapter entitled "Communication and Visual Literacy," Simonson and Volker address the following topics: understanding communication; reception, perception, and recognition; individual and group communication; visual literacy; designing visuals; understanding literacy in visuals; and visual communication research. Although the visual literacy movement itself is not mentioned, the reference section directs readers to some important sources to fill this gap, though the International Visual Literacy Association is not listed. Strengths of this book include the reference section, student review, and suggested activities for fostering visual literacy. The inclusion of research in visual communication (i.e., media production, content and utilization of visuals, and attitude formation) is also unique. An instructor using this text might want to supplement the material on elements of visual design and might want to make students aware of the visual literacy movement, but the text provides students with a fairly balanced and comprehensive introduction to visual literacy.

Heinich, R. , Molenda, M. , & Russell, J. D. (1982). Instructional media and the new technologies of instruction (2nd ed.). New York: Macmillan.

Heinich, Molenda, and Russell title an entire chapter "Visual Literacy" and in clude the following topics: concepts of visual literacy,visual referents, realism in visuals, picture preferences, teaching and learning the skills of visual literacy, photography for instruction, viewing visuals, and designing literate visuals. The International Visual Literacy Association is specifically mentioned and the visual literacy movement and its impact on education is discussed. A strength of the text is the inclusion of suggested activities to foster visual iteracy and an extensive list of print and non-print resources. The text offers a balanced, comprehenseive introduction to visual literacy and an instructor could answer each of the the five questions posed in this paper in the affirmative. However, advanced publicity regarding the third edition of this text indicates that "the emphasis as well as the title have been shifted from 'Visual Literacy' to "Visual Design"".

James D. Russell, co-author, indicated in a telephone conversation on October 10, 1988, that the revised chapter still mentioned the visual literacy movement and the International Visual Literacy Association but had been expanded to include sections on the design of text and computer graphics, fundamentals of cartooning and sketching, and more on photography and the visual elements of design. Russell indicated that the emphasis had been shifted from visual literacy to visual design in response to comments from instructors. Russell also noted that the instructors to whom he had spoken felt that the term visual literacy had become more common and widely accepted over the past few years and that the visual literacy movement had become part of the educational mainstream.

Summary

A wide variety existed among the texts analyzed in terms of their coverage of visual literacy issues. Elements of visual design were the most likely aspect of visual literacy to be included in general media and technology texts, while only one text advised readers that an international organization devoted to fostering visual literacy even existed (perhaps those of us involved in the International Visual Literacy Association should take this as a call to action!)

Instructors concerned about introducing pre- and in-service teachers to the tenents of visual literacy during the course of general media and technology classes should acquaint themselves with the content and scope of their particular textbooks, and be prepared to supplement the instruction provided. Concerned instructors selecting new texts for general media and technology classes should also be aware of the diversity among texts and select one which will provide students with an introduction to the basics of visual literacy.

It is hoped that this investigation and the annotated bilbliography will help instructors of general media and technology courses integrate visual literacy into their classes so that more pre- and in-service teachers will become aware of visual literacy and its influence upon teaching, learning, and life. In this way, progress may be made toward Fransecky and Debes' goal of a teaching force with every instructor being a teacher of visual literacy.

Reference

Fransecky, R. B., & Debes, J. L. (1972). Visual literacy: A way to teach--a way to learn. Washington, DC: Association for Educational Communications and Technology.

Contemporary Strategies in Photographic Education

Debra Drees Risberg
Illinois State University

My personal experience in photography has evolved through several stages during the past fifteen years. It began in a photographic and audio visual technology program immediately followed by two years of commercial work at a studio in Florida. I found that tools and technique alone did not provide the kind of stimulating career I had hoped for, so I pursued my education in journalism and design, and went on to complete a master of fine arts in photography.

After several productive years in fine arts photography, including two years of teaching, I was offered a teaching position in the Department of Communication at Illinois State University. It was because of my diversified background that I was considered for the position. The department only offers students one semester of photography at this time so I have designed a course that integrates many facets of the medium. Most of my students are mass communication and public relations majors but the course is appropriate for most upper level undergraduates.

Assignments are similar to the usual basic photography format but there are ways of conducting an assignment that challenge students on more than one level. The limitations of the medium in terms of communication are addressed in each assignment. Limitations would include, the translation of color to shades of grey, framing, taking one moment out of context to represent something with continuity, one point perspective, etc. Through becoming aware of the limitations of the medium, one also begins to create new possibilities.

With the help of undergraduate assistants who have previously taken the course, we have been able to generate an attitude of cooperation and involvement. The results are evident in the quality of the students work. The lab assistants influence the beginning students experience to a great extent and I am careful in choosing the assistants for each semester.

It is always difficult to design fair criteria for evaluating photographs and that criteria will change from professor to professor. When creative production is involved a degree of subjectivity is present. If the course is to succeed, a student must develop a sense of inherent value in their work. They are bound to be confused and frustrated if grades are their only objective. This can be a tough barrier to cross for students and teachers. The following are some methods I use for increasing the odds that a student will break through the grade barrier and begin to consider the value inherent in their experience and the pictures they make about it.

Presenting examples of past student work helps define my criteria for grading and generates ideas. When they encounter the variety of solutions already tried (not all of them successful) it reduces their anxiety which is more conducive to inspiraton. I encourage the expression and sharing of ideas. They often work on the same ideas semester after semester and the work evolves. This method of sharing limits their dependence on an instructor's subjective opinions.

The facilities are student-run. If they are to be well maintained, a community effort between the lab assistants and the students is required. I seldom have to interfere although I originally set up the system. The system we use is always subject to change if the students feel that a change is necessary.

Students and lab assistants spend many hours a week together. There is always someone there to help students with their assignments. I try to foster a sense of responsibility for the facility and equipment, rules can not be enforced without student involvement and cooperation. It is essential that there is a community space conducive to working, interacting and learning.

Over the semester, we have a number of class critiques. The students bring in their work and discuss it in class. They have told me that the critique is instructive, interesting, and a significant part of their education. It is a time when I can talk about their individual pictures and offer constructive criticism. Although finding constructive things to say about each photograph can be difficult for the instructor, there is nothing that can take the place of a critique in terms of learning for both students and professor.

The critique is an invaluable resource for teaching students to verbalize their ideas. It also draws attention to the differences between verbal and visual interpretation.

Last semester we were able to reserve exhibition space in the university library. We have had two student shows and intend to have at least one each semester. Exhibiting their work is a validating experience and something I intend to continue. I occasionally ask students to donate a print to the department and we have begun to collect an archive of work that the department can exhibit over the years.

Now that I have described the "setting" for the course I will pursue more academic issues and follow with a description of the assignments and examples of student work.

Over the past two decades photography has been embraced by the intellectual, Susan Sontag's ON PHOTOGRAPHY, the art critic, John Berger's WAYS OF SEEING, the deconstructionist, Douglas Crimp's publication, OCTOBER, and countless others. After 150 years of photographing ourselves we are now in a process of examining the results, hoping that there is some method for interpreting photographic meaning and applying it to cultural understanding. Presently there exists a multitude of opinions and questions that are both interesting and challenging. Through this exchange, hopefully, new forms of representation and visual communication will emerge that will address essential human issues more successfully.

Moholy Nagy, early in this century announced, "The illiterate of the future will be ignorant of pen and camera alike". This generation is not ignorant of the camera but the relationship tends to be passive instead of interactive and critical. The process of creating one's own visual messages alters that passive relationship by allowing the image-maker to represent and validate their individual experience.

Students who take photography courses are usually interested in the technical and creative aspects of the medium. In a basic production course I think it is possible to meet their expectations and to introduce them to more complex issues.

Degrees in photography have been offered at most major universities for over twenty years. The consequence of this outpouring of sophisticated imagemakers is evident in todays advertising, entertainment and educational television, and the news media. Since photography has become an essential element in the distribution of ideas and information and the selling of products, many educators have been paying more attention to the role of photography in our cultural experience.

A method of observing this process is through developing an awareness of the extent to which our worldly experience is controlled by pictures, particularly in news and advertising.

This experience is created for us by someone else. A manufactured reality competes with first-hand experience. Do we trust our own experience any more than we trust the mediated experience? Perception requires energy and attention, but when we have information framed, focused, edited and neatly packaged into easily digestible segments the temptation to let someone do it for us seems to be irresistable.

The danger in accepting this situation is that it renders us powerless in defining what our true situation is and in pursuing a course of action that could improve the existing circumstance. Ideally, through their photography, the students will not only learn technique but they will learn the importance of attending to first-hand experience and applying it to their own self-definitions and representations.

Education implies the aquisition of the powers of reason and judgement. How can making pictures and examining pictures contribute to a students education beyond a technical level? There are several methods I use that have met with success and I am interested in developing more. Few if any of my students have had former instruction in photography or art. We start at scratch and end up with some very interesting results.

ASSIGNMENTS

The first assignment I give to my class is pinhole photography. With Quaker Oats box and polyprint paper at hand they are sent out into the environment to make "compositions". Through their expierence with the pinhole they learn about image formation by light, basic camera functions, and the limitations and possibilities of the medium in terms of perspective, lighting, light sensitive emulsions, and printing. They are encouraged to use the inherent qualities of the pinhole camera such as long exposure times, distortion, and limitless depth-of-field to their best advantage.

They also learn to control exposure, development and contrast, and to make positive contact prints. I stress the importance of presentation technique in each assignment. Each pinhole image is printed on a full 8x10 surrounded by a dense black border.

We discuss the communicative possibilities in figure-ground relationships, the difficulty in composing an image without a viewfinder, and the differences between the photograph and the way they originally percieved the scene. This semester ten pinhole images were framed and exhibited in the library along with a pinhole camera and a brief description of the assignment.

The next three assignments are devoted to the themes of light, space, and time. We begin with what I call the composition assignment. This assignment involves shooting an entire roll of film, each frame in formal relation to the others, creating one composition from 35 separate images. The final composition consists of one proofsheet. The assignment requires conceptual thinking, previsualization, and complete attention to the organization of every frame of film. I emphasize the possibilities of incorporating multiple times and perspectives into the final pieces.

In the light assignment we work with available light, usually window light for a portrait, a photogram or light drawing made directly on paper without the use of a negative, reflections and shadows as part of the overall composition of their image, and light drawings made in the camera. The emphasis on reflections and shadows in the assignment is to challenge students to become more aware of their environment and how light interacts with objects. Reflections are also used to include more than one perspective in a picture.

The time assignment involves technique and interpretation skills. Various methods of showing time are demonstrated such as stop action, panning, blurred motion, and sequential images. We also discuss ways of interpreting time in an image. Students are asked to define their relationship to time in words and to think of images to describe that relationship. One of the most interesting solutions to this problem was a close up of a parking meter by a business student.

In learning about portraiture students are introduced to work that is more content oriented, but the examples I use in class tend to be by photographers who impose strong individual styles on their work. This is mainly to show alternatives to traditional methods of taking portraits. It is my intention to limit emphasis on content until the latter part of the semester after technical and visual skills have been practiced. It is at this juncture that we begin to address the expressive potential photography has for revealing human concerns.

The final weeks of class are devoted to documentary, photojournalism and information services photography. Text and layout techniques are also introduced. It is at this point that students are expected to choose a theme for their work and to begin making a series of related photographs. They are shown various ways of presenting their work and are required to choose one that suits their topic. This semester we instituted a week-long workshop at Media Services. During the week students learn to work with presentation materials, layout design, and graphics, including basic computer graphics and laser printing. Generally students decide to eather mount or matt their prints, make a panel exhibit using foam core, or present their work in book form. Their final projects must include text. The style and amount of text is determined by the content of their photographs.

We look at examples of "socially concerned" work by Lewis Hine and the photographers of the Farm Security Administration and discuss the impact of their work. Contemporary documentary work is also presented, such as the neutral and ironic style used by Bill Owens in his books of environmental portraits, Suburbia, and Working (I Do It For The Money). More recent photojournalism by socially concerned photographers such as Susan Meisealas is also included. Instead of looking for exotic subjects and "news" students are encouraged to document a subject that interests them even if they know little about that subject. They will learn about their subject as they research and photograph it. I am more interested in their ability to express their individual interests and experiences than I am in trying to impose a particular aesthetic or philosophic point of view.

One of the greatest rewards in taking a photography course is the photographs you have to keep after the class is over. I have found over the semesters that the majority of students take pride in their work. Only they know if it has met their expectations. Some of the final projects have been used by local non-profit organizations. Often students will find that they can relate their photography to other courses, particularly those dealing with public relations and journalism. Students learn about the community through their photography and they also find that their work is valuable to others.

I have been recruiting student photographers for our local ballet company and Project Oz, a community based drug education program. We are promoting a positive relationship between the university and community by serving the community and taking an interest in the local people.

Connections between contemporary theory and the basic course I have described may seem vague and presumptuous. The manner in which these ideas are incorporated into a fundamental course is indirect.

Photography is a unique and a limited form of communication. Re-presentation is always different than first hand experience. A Photograph can be passively accepted as truth, it can be simplistic or overly complex and dense. A mediated message should be looked at skeptically including the producers of the message and their motives.

Ideas are not property. They are generally borrowed from and generated from within a group. There can be many creative solutions to a given problem. We should look for alternatives, not perfection. There is no prescribed method for visual communication. It is a cooperative endeavor between the image maker and the audience.

Observation, perception and message composition can be mastered through photography. Refining these skills improves one's reasoning and critical faculties as a media consumer and producer.

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Visual Literacy Courses at the College Level: Panel Discussion

Rhonda Robinson, Northern Illinois University
Barbara Seels, University of Pittsburg
Nikos Metallinos, Concordia University
Landra Rezabek, University of Wyoming
Frank Dwyer, Penn State University
David Considine, Appalachian State University

Symposium Overview

Many colleges and universities are realizing the importance of adding courses in visual literacy to their curricula, especially in education and art. These presenters shared their experiences in designing and teaching courses in visual learning at several universities. Ideas for starting and "selling" similar courses were presented and discussed by the participants.

This symposium focused on the design and delivery of college-level courses in Visual Literacy and Learning. Course syllabi and instructional strategies were shared with the audience. Sample assignments and evaluation of students were discussed.

Each of the participants has (from their own unique perspective) developed and instructed a course in visual literacy. These courses are offered for teacher education, for liberal arts students, for media specialists and for educational technology students. Most courses are at the graduate level, although a few are designed for undergraduate/graduate credit. Each course has its own focus and each instructor works from their own philosophy and theoretical constructs.

First, Frank Dwyer presents his doctoral level course, "Research in Instructional Systems." His class focuses on the research in instructional systems and on the development of a basic research proposal in visual learning.

Second, Nikos Metallinos discusses "Television Aesthetics," in which the artistic elements pertinent to television are presented. The course includes a number of exercises which allow students to practice various principles of elements such as lighting, staging, audio, and screen utilization.

Third, David Considine describes the course in "Critical Viewing Skills" he developed for the media studies program. An interdisciplinary course, the focus is on critical thinking, critical viewing, and the roles of images, symbols, and various media applications in forming our educational methods.

Fourth, Barbara Seels introduces her course on "Visual Thinking and

Learning." The class is aimed at helping students think visually and interpret and use pictures. Course activities include many exercises and experiences which help students develop their visual skills.

Fifth, Rhonda Robinson shares her course, "Visual Learning," a workshop, survey-type course in visual literacy. The course involves activities in the encoding and primarily the decoding of visuals in many media, including graphics, photography, television, film, and computer screen design.

Last, Landra Rezabek presents her new (Fall 1988) course, "An Introduction to Visual Literacy." Landra modeled her course from several of the others, adding her own special interests. And, it is taught *orally*, through the state telecommunications system as well as on campus.

Each author has available syllabi, objectives, activities, and readings. Due to space limitations in the *Readings*, these have not been included. However, authors would be glad to provide such information upon request.

We hope that the recommendations here for objectives, activities, readings, projects, and further research will help others in their definition of and their teaching about visual literacy. The more these ideas are shared, borrowed, and adapted, the more students will have access to the principles of visual literacy.

LEIT 492/592: VISUAL LEARNING
"LEARNING TO SEE"

Dr. Rhonda S. Robinson
Northern Illinois University
Department of LEPS

Required Text:

Dwyer, Francis. (1978). Strategies for improving visual learning. Learning Services, State College, Pennsylvania.

Recommended Text:

Willows, D.M. and Houghton, H.A. (1987). Psychology of illustration, Vol. I, Vol. II, Springer-Verlag, New York.

Readings as assigned (copies available for student use on reserve in the Learning Center).

Course Goals:

The course will familiarize students with:
- the concept of visual literacy and pictorial competence;
- the aesthetic elements of still and motion visuals;
- various theoretical approaches to the study and interpretation of visual media;
- overt and subliminal messages imbedded in images in a variety of media formats; and
- the instruction of critical viewing skills to various audiences.

Course Objectives:

The course familiarizes students with visual media, both still and moving images, and helps students develop the ability to critically analyze and interpret media messages. Students will:

- review the concept of visual literacy;
- understand visual imagery;
- analyze visual communications;
- identify design and production elements in visuals;
- appreciate the aesthetic elements of film and television and the language they use;
- review visual learning research and apply it to specific projects;
- critically analyze and interpret the visual elements of still and motion visuals.

SUMMARY OF COURSE ON VISUAL THINKING AND LEARNING

Barbara Seels
University of Pittsburgh

Description: This course provides an opportunity to explore the uses of imagery, how visual abilities develop and visual thinking processes necessary for creative communication.

Goals: To increase interest in and valuing of visual thinking and learning. To increase knowledge and understanding of principles on which visual thinking and learning is based.

Objectives:

1. Think visually
2. Interpret and use pictures
3. Understand: elements, operations, functions, aesthetic and instructional properties
4. Develop: visual ability and visual presentations

Evaluation: Primarily subjective. Based on discussion, exercises, portfolio, presentation and essay. The criteria will be extent to which content reflects principles of visual thinking and learning and extent to which product and process give evidence of fluency, flexibility, elaboration, organization and arrangement of parts, uniqueness and spirit of experimentation.

Format: Presentation of principles interspersed with materials, exercises and experiences that exemplify principles (films, games, exercises, kits, slides and photographs).

strongly, the course and its value becomes very apparent to them very quickly.

The course then moves through the consideration of various visual media including illustrated children's books, advertising, television, motion pictures and television news. Particular attention is given to stereotyping and to distortion and misrepresentation. Emphasis is also placed on mass media images as the window on the world for impressionable children and adolescents. The emphasis of the course in not only on the need for students taking the course to understand the role of visuals in American Society, but for the need the American school system has to address images in order to both improve the instructional process and to make instruction more meaningful and relevant to children who live in a highly visual environment.

CRITICAL VIEWING SKILLS

David M. Considine
Appalachian State University
Boone, North Carolina

The course in critical viewing skills offered at Appalachian State University is offered as part of the Media Studies program in the Department of Curriculum and Instruction in the Reich College of Education. The course is a prerequisite to the Masters program in Media Studies and one of the two compulsory courses in the undergraduate minor in Media Studies.

It is an interdisciplinary course that seeks to attract students from a wide range of fields. Traditionally, students who take the course are majoring in communication arts, broadcasting, graphic arts, marketing and, of course, media studies. In addition, the course has attracted the interest of students in philosophy, history, fine arts and management. It is regrettable that the course has so far failed to attract the number of education majors that it had hoped for. Education majors who have expressed an interest in the course include full-time teachers who attend the university part-time for recertification. State requirements and the extremely narrow range of options and electives open to them mitigate against them taking the course. This fact is currently under consideration, and plans are underway to raise the level of awareness of educational administrators throughout the state to this need. Comments from employees of the State Department of Public Instruction further substantiate the belief that a different perception of priorities exists among politicians, educational administrators and teachers in North Carolina when it comes to the entire issues of media and technology in education.

The course regularly attracts 20-25 students which is above the state average for students in a course. Students completing the course regularly comment through their required journals and classroom discussion that they had no idea how pervasive images were in the American consciousness and how little the general public knows about the impact of images in their lives. Students also frequently report feelings of depression and powerlessness as a reaction to much of the information the course exposes them to. Ultimately, however, when they evaluate the course and the instructor, students report that it has been beneficial to them and they have enjoyed it. This response is particularly interested in the concept of critical television skills, ways to monitor their children's viewing behavior and ways to make it a more positive experience.

The course looks at the relationship between critical thinking and critical viewing, including an examination of traditional teaching methods and a curriculum of consensus. McKim's notion of stereotypical seeing and stereotypical thinking is part of this initial approach. In addition students are forced to confront the origins of their perceptions and the role of images in them. One example of this comes early in the course when students study symbolism and concentrate on the cultural controversy of the Confederate flag in the south.. For many students (both black and white) this is a particularly volatile issue that brings the impact of images in our life forcibly home. Students also examine A.C.L.U. challenges to state sponsored images of Christmas including crosses and Christmas trees. By forcing students to confront the origins and symbols of beliefs that many of them hold very viewer--we have achieved a fundamental educational objective in this course.

The methods used to study television aesthetics, and consequently to achieve such educational objectives, are provided in detail in the course syllabus available upon request.

TELEVISION AESTHETICS

by
Nikos Metallinos
Concordia University
Montreal, Canada

Television aesthetics is the study and application of aesthetic principles pertinent to the television medium. it examines the basic elements of the television picture such as light, color, space, time, motion, sound, etc., in relationship to the finished product--the television program.

The basis for the development of the course are found in the principles of contextualistic aesthetics which stress the essential, intimate, purposeful relationship between art and life. Contrary to the isolationists, who insist that valid aesthetic experience can happen only when one is confronted by a magnificent work of the "pure arts" and that "life is one thing and poetry (art) is another," the contextualists believe that life and art are interconnected and inseparable. Aesthetics then, according to contextualists, is the process of ordering, classification, intensification, and interpretation of experience.

Equally connected are the various elements, the fundamental components that make up the television picture and the end product--the television program.

In this context, the television medium is seen not merely as a vehicle to transfer visual and auditory messages, but as an art form which is capable of creating works of art, totally connected to life experiences. As such, the medium of television becomes a manipulator, a re-shaper of the emotional and intellectual properties of the viewer and this creates an enormous responsibility to those who construct television images for mass consumption.

It is for this reason that the study of how such television images are made, what they are made of, and how the basic elements of the television images are related with each other, is so important.

The course is based on four axes: (1) aesthetics, (2) perception (both visual and auditory), (3) composition, and (4) television factor analysis. In the first axis such topics as art, criticism, and aesthetics of the arts in general are examined. In the second axis the process and the principles of visual and auditory perception laws are examined in relation to the television images. The third axis examines the major principles of art composition, with emphasis given to the visual communication media. The last, and most significant axis of the course examines, in great detail, the basic elements of the television pictures.

The ultimate objective of the study of television aesthetics is to stress the close relationship between the technical aspects and skills required in the television medium and the ethic and moral responsibilities of the medium towards the viewer. By sensitizing the students to the inner workings of the television medium, which is capable of altering the emotions and the interests of the viewers, and by stressing the moral and the ethical responsibilities of the television communicators towards their fellow man--the

INSTRUCTIONAL SYSTEMS 532
Fall Semester 1988
August 26 - December 9

F. M. Dwyer
Penn State University

TITLE:	Research in Instructional Systems
CREDITS:	3
INSTRUCTOR:	F.M. Dwyer, 148 Chambers, 865-6569
SECRETARY:	Pat Simmet, 140 Chambers, 865-6569
REQUIRED TEXT:	Strategies for Improving Visual Learning, 1978. Student Manual
GOAL:	To understand and appreciate the contributions that research makes to the design and development of those instructional systems which have a high degree of predictability in achieving predetermined levels of achievement. This goal requires that it be understood that research--like the concept of instructional systems--exists as a interrelated constituent process operating at varying levels of complexity the elements (and results) of which acquire significance (and meaning) only in the context in which they are used.

General Objectives

A. Provide a general overview and understanding of instructional (visual) systems research.

B. Formulate the conceptualization and development of a basic research proposal.

C. Provide an opportunity to critically review a published article.

D. Provide an exposure to some of the basic literature in the field.

E. Provide an opportunity to conduct library research on a specific independent variable.

F. Provide an orientation to the theories of Gagne, Rothkopf, Ausubel, etc. and instructional systems design.

G. Provide a basic orientation to experimental design.

AN INTRODUCTION TO VISUAL LITERACY

Landra Rezabek
University of Wyoming

Although an "Introduction to Visual Literacy" course has been an approved offering in the College of Education at the University of Wyoming since 1974, the class had not been taught since the fall of 1980 due to shortages in faculty or to student disinterest. However, the fall semester of 1988 provided us with both faculty and students who were excited about investigating the topic of visual literacy.

As stated in the available syllabus, the goals of this course were to acquaint students with the basic concepts and "strands" of visual literacy, to provide students with practice in encoding and decoding visual messages, and to challenge students to integrate visual learning and literacy activities into their own instructional settings. Since the majority of our students were practicing or pre-service teachers, our focus was on how the principles and theories of visual literacy can improve instructional practice.

Throughout the course we stressed that we were enjoying a smorgasbord of visual literacy -- a scoop of design and communication; a spoonful of research issues; a taste of photography, video, and film; a serving of classroom application -- but that, not all of the delicacies of visual literacy were served in the class! Students were required to investigate their own ares of interest and to design an instructional unit to further the visual literacy of a selected target population as a final project, and we will share our learning at the end of the semester.

An interesting aspect of the visual literacy course at the University of Wyoming is that the course is being taught both on- and off-campus this semester. Two off-campus locations are linked to Laramie by an audio teleconference system as well as by the Optel computer/graphics/video communication system. A variety of media such as film, slides, and videotape also are used. Though the content of both the on-and off-campus courses is the same, delivery is quite different and remarkably challenging when using an audio teleconferencing system to investigate visual literacy! Course sequencing must be carefully revised to allow time for mailing materials, feedback becomes a major concern for an instructor, and we are continually learning to work with the strengths and limitations of the Optel system during this pilot project. I hope to share the positive and negative aspects of both on- and off-campus courses with my colleagues at our next IVLA conference.

I would make revisions to the existing course -- I would add material to address the influence of television and computers, would like to include more about perception, and have also discovered additional readings and potential texts. But both on- and off-campus students are excited about and involved in the class and have been discussing how visual literacy instruction can be integrated into their particular learning environments, and we now hope to offer an introduction to visual literacy to our pre- and in-service teachers on a regular basis. I value the input of IVLA members who have shared their course ideas and I encourage us to continue this collegial exchange.

The Effect of the Animation Variable in Computerized Instruction on the Comprehension and Application of Concepts of Perspective Drawing

Susan Roth
Ohio State University

The purpose of the study was to compare the effectiveness of two types of computerized instruction: animated and non-animated. The instructional unit concerned principles of perspective drawing. The hypothesis was that an animated version of the presentation would be significantly more effective than a non-animated version of the same presentation.

To test the hypothesis, the experiment was designed to follow a pretest-treatment-post-test format. Subjects were placed in ability groups based on pretest scores, after which they were randomly assigned to the two treatment groups. Effectiveness of the two methods was evaluated by administration of an objective-referenced written post-test immediately following treatment, and a drawing post-test administered two days later.

Research has shown that there is a need to examine individual variables in visualized instruction in order to develop effective instructional programs. Dwyer (1972) proposed a model for empirical development that suggested the following procedure: 1) limit research to one subject area containing an instructional unit having within it several different kinds of learning tasks; 2) devise criterial tests to measure student achievement; 3) keep the information in the instructional unit constant; 4) establish multiple versions of the initial visual sequence; 5) identify and randomly assign students to treatment groups; and 6) administer criterial tests immediately after students receive the instructional unit. The investigations of Gavriel Salomon (1979) concerned the effect of variables in visualized instruction on learners of different ability levels. Working primarily with the medium of film, Salomon devised two different versions of the same presentation which depicted certain mental skills either partially or completely. In the case of the "changing points of view" experiment (p. 152), subjects were pretested for the ability to imagine objects from changing points of view, then presented with three forms of treatment or training. The first, called modeling, consisted of a film in which the camera moved around objects in order to show explicitly the phenomenon of changing viewpoints. In the second treatment, termed short-circuiting, slides were shown of the intitial view and the final view. In the last treatment, called activation, only the first slide of the initial view was shown. Performance of all subjects on tasks requiring changing points of view was measured after treatment. It was found that subjects with low initial skill levels improved most after exposure to modeling, while more highly-skilled subjects were aided most by activation.

In the present study, the animation of selected sequences in the presentation demonstrated an underlying concept of perspective drawing: the visual appearance of an object depends on the position of the object in space or the position of the viewer relative to the object.

A change in position changes the appearance of the object. In the case of perspective drawing, convergence and dimunition are characteristic of the changing appearance of form in space. Convergence occurs when lines that are in reality parallel appear to meet or converge at a point on the horizon line. Dimunition describes the visual effect in which objects appear to get progressively smaller as they recede from the viewer.
Figure 1, from The Perspective Drawing Handbook (D'Amelio, 1964), illustrates the phenomena of convergence and dimunition.

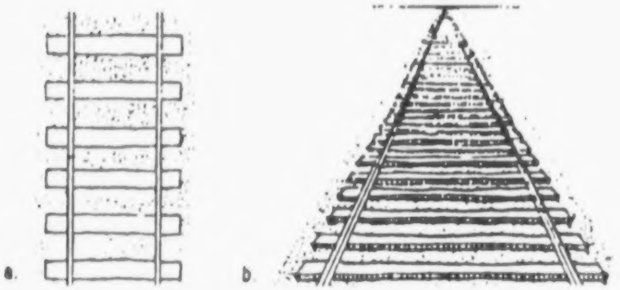

Figure 1. An overhead view of railroad tracks (a) demonstrating parallel elements, and a perspective view (b), demonstrating convergence and dimunition of elements.

For the presentation on perspective drawing, animation was selected to visually portray the motion of an object and demonstrate the changing appearance of form.

Method

Subjects

Subjects for this experiment were drawn from students enrolled in a preprofessional drawing course in the Department of Industrial Design. Of the twenty-two students given the Hidden Figures pretest, nineteen returned for the presentation session. These nineteen comprised the final sample. Twelve subjects were male, seven were female, and the average age was twenty years. A questionnaire administered to subjects before the pretest indicated that eighteen of the original nineteen had previous experience with the use of a computer; eleven of the eighteen stated that their impression of the experience had been favorable, and seven indicated a very favorable impression.

Materials

The presentations were viewed by subjects in a computer laboratory on the main campus of The Ohio State University. Each subject had a Macintosh Plus microcomputer equipped with an internal and external drive and a mouse which controlled a cursor on the screen. The software consisted of two versions of a presentation developed by the investigator, and consisted of material on perspective drawing in a format designed expressly for the computer. A commercially-available software program was used to organize the timing and sequence of individual frames in the presentation. A three-dimensional drawing program was used for creation of the geometric forms to be animated. Individual frames in which the image was moved by increments of ten degrees were drawn. When placed in sequence and timed to run as an animation, the figures appeared to move.

Each subject received one presentation disk and one start-up disk that enabled the presentation disk to run. Ten of the presentation disks were animated, ten were not animated. The presentation was automatically timed to proceed at a specific pace, but the pace and direction of the presentation could also be controlled by the subject. A "control panel" located on a pull-down menu or at the top of the screen enabled the subject to go back, go forward, stop or rewind the presentation at any time. In addition, a click of the mouse button would advance the presentation to the next frame in the event the subject wished to proceed through the material at a more rapid pace than that provided by the automatic timing.

Procedure

Subjects were placed in three groups, or levels, according to pretest scores. The Hidden Figures Test is a standardized test published by the Educational Testing Service. The test is formulated to measure the factor of "flexibility of closure", defined as "the ability to hold a given visual percept or configuration in mind so as to disembed it from other well defined perceptual material" (Ekstrom, French and Harman, 1976, p.19). Test results were evaluated according to guidelines published in the test manual. The number of correct answers was modified by subtracting one quarter of the incorrect answers in order to arrive at the total score. All scores were compiled in a list, and the list was divided into thirds to arrive at the three categories: high, medium, and low.

The two versions of the presentation were distributed to subjects randomly assigned to two groups. After verbal instructions were given to all subjects, they were permitted to proceed at their own pace. A time period of approximately ten minutes was spent on preliminary instructions, which proved to be sufficient because of the simplicity of operating the software program and the Macintosh Plus. Subjects were told to view the material at least twice, or as often as necessary to adequately comprehend the concepts in the presentation. They were advised that a test would be given after viewing the presentation to test comprehension.

The presentations were programmed to run approximately fifteen minutes, with the animated presentation lasting longer due to the extra frames required for animation. In all other respects, the two versions were identical. The subjects finished viewing the presentations at different times, and after the disks were collected, they proceeded to fill out the written post-test form. The last subject finished the test approximately one hour after beginning the procedure. Two days later, during the next scheduled class session, a drawing post-test was administered. Subjects were asked to construct perspective drawings in response to problem statements based on material presented in the instructional unit.

Results

Written post-test

Results of the written post-test indicate that there was no statistically significant increase of effectiveness attributable to the animation variable, although the animated group achieved a higher mean test score than the non-animated group. Highest scores on the written post-test were produced primarily by subjects in the animated treatment group who were also in the high-ability group. Other groups did not show a similar correlation. Data analysis revealed that scores on the Hidden Figures Test were lower for female subjects than male subjects. As a result, the low-ability group contained a larger percentage of female subjects.

Drawing post-test

Results of the drawing post-test revealed that subjects were able to apply some basic concepts from the presentation, but generally did not apply concepts necessary for the accurate construction of perspective drawings. Content analysis revealed a pattern of common drawing errors. There was no effect of treatment on performance on the drawing post-test, but there was a correlation between ability level and performance. Subjects in the high-ability category had fewer errors, and fewer types of errors, than subjects in the medium-ability category. The low -ability group showed the greatest number of errors and types of errors.

Data

Written post-test. Results of the objective-based written post-test indicate that the mean score obtained by the animated group is higher than that of the non-animated group (19.1 vs. 18.22), but the unequal distribution of subjects in trait/treatment groups prevents a conclusive comparison of group means. A two-factor ANOVA, with pretest score and treatment as independent variables, shows that the between-group difference is not statistically significant at the .05 level.

However, reviewing the data according to number of errors on the post-test indicates that approximately twice as many errors were produced by the non-animated group (1.89, vs .9), and that six out of seven perfect scores (no errors) were achieved by subjects in the animated group. Five of the six subjects with perfect scores were also in the high category as a result of achievement on the pretest, but those in the low category in the animated group produced fewer errors than those in the medium category. The number of errors in the non-animated group was greater for the low and high categories and slightly less for the medium category. Therefore, with the exception of the high category/ animated group relationship, there does not appear to be a correlation of trait (pretest score) or treatment (animated vs. non-animated presentation) with performance on the written post-test.

Drawing post-test. Results of the drawing post-test were subjected to content analysis. Drawings made by subjects in response to problem statements were analyzed in terms of specific categories, such as *application of defined concepts* , that had been presented in the instructional unit. There was application of some defined concepts, as indicated by the successful completion of assignments such as "Draw a cube above the horizon line in two-point perspective." For this assignment, the subject had to know the meaning of *horizon line* and *two-point perspective* and understand the relationship between the two meanings in order to draw the cube correctly. All students showed an understanding of the concepts described above, however there was often a failure to apply other concepts and rules, such as the fact that perspective lines in a two-point cube converge towards vanishing points located on the horizon line. In several cases, these lines were depicted as parallel, creating a cube drawn in isometric projection.

Results of the drawing test were also analyzed in order to discover which drawing errors had been produced by subjects. This process involved examination of drawings, compilation of errors, and recording frequency of occurence. By creating a matrix with students placed on one axis, and error categories placed on the other axis, it was possible to see which errors were most frequent, and which errors had a tendency to appear in conjunction with others.

The most common drawing errors were (1) the cube was too wide; (2) the bottom face of the cube was too large or distorted in shape; and (3) the cube was drawn with parallel lines rather than perspective lines, creating an isometric projection. The most prevalent error was making the cube too wide, especially when drawn in two-point perspective; thirteen out of nineteen subjects made this error. Another frequent error was distortion of the base of the cube, when drawn in two-point perspective above the horizon line. Ten out of nineteen subjects made this error. There was often a conjunction of these two errors: in seven out of ten cases where the bottom face of the cube was distorted, the cube was also too wide. This relationship may be the result of drawing procedure. The simplest procedure for drawing a cube in two point perspective is to draw the two side faces first. On the drawing test, these were often depicted as too wide. If the bottom face of the cube were drawn last, its shape would depend on the configuration of existing lines, and would have been distorted by previous drawing errors. Another possible explanation for the distortion of the last face is suggested by the research of Van Sommers (1984). He reported that when subjects in his study were shown an illustration of a (two point) cube, they attempted to duplicate it by drawing the faces equal in area and nearly square. By drawing the first two faces nearly square it became necessary for subjects to align them at an open angle. According to principles of perspective, the wider the angle, the smaller or flatter the last face would actually appear. But in order to maintain the desired equality of area in each face, the bottom face (which was drawn last) was often distorted or pulled away from its correct position to increase area (see Figure 2, from Drawing and Cognition, 1985).

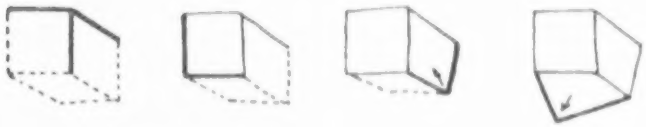

Figure 2: An example of the "last face drawn" error, in which the bottom face has been distorted in order to increase the area. Construction of the drawing proceeds from left to right.

The same interpretation could be applied to the tendency of subjects to make the side faces too wide so that each approached the shape of a square. Incorrect proportions of cubes drawn in two-point perspective may be due to lack of drawing experience on the part of subjects, but it is interesting to note that the cube is almost always too wide, not too narrow. This fact suggests another possible explanation. The "horizontal-vertical illusion" is a well-known visual illusion described by Zusne (1970, p.163). Two lines of equal length are arranged perpendicularly, causing the vertical line to appear to be longer (or taller) than the horizontal line. The illusion also applies to objects with a horizontal and vertical dimension, as evidenced by the illustration of a top hat in Figure 3 Is it possible that subjects are making the cube wider to compensate for the fact that the vertical dimension appears to be taller than it is?

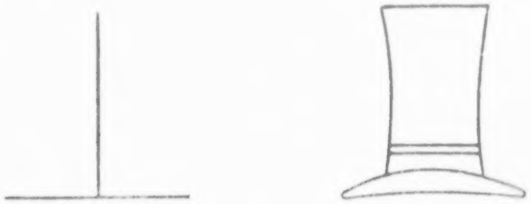

Figure 3: The "horizontal-vertical illusion", from the Visual Perception of Form (Zusne, 1970). The illusion is apparent in the perpendicular lines (a), which are the same length, and in the top hat (b), which is as wide as it is high.

Drawing cubes in isometric projection is an error less prevalent than the others described. Seven out of nineteen subjects depicted cubes in isometric rather than perspective projection. When a cube is correctly drawn in perspective the edges are defined by perspective lines (not the parallel lines found in an isometric projection) which project back into three-dimensional space and converge at common vanishing points on the horizon line (see Figure 4).

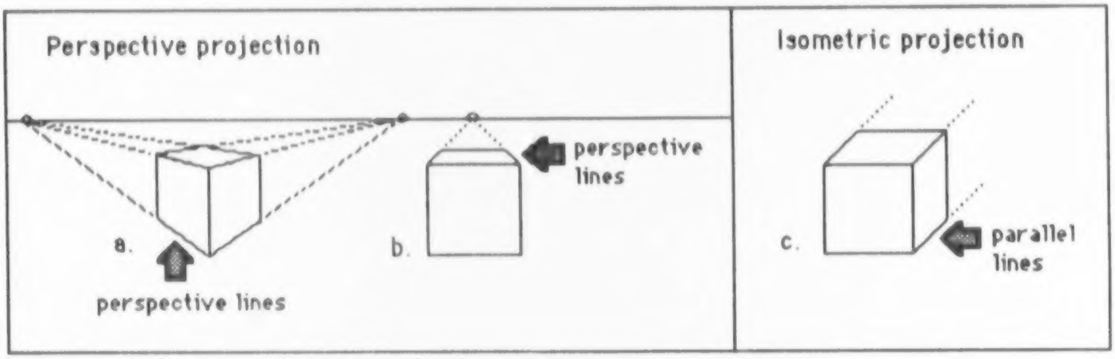

Figure 4. Cubes drawn in two-point perspective (a), one-point perspective (b), and isometric projection (c). Both (a) and (b) contain perspective lines, which meet at vanishing points on the horizon line; (c) contains parallel lines only.

After common errors were established by an analysis of drawing test results, the next step was interpretation of the number and types of errors relative to the independent variables. These variables were: HFT ability level (high, medium, low) and treatment group (animated vs. non-animated). Whereas there was no effect of treatment indicated for performance on the drawing test (each treatment group had a mean of 2.2 errors), there was a correspondence of number of errors, type of errors, and ability group. The high-ability group had half the errors, and less than half the types of errors, of the low-ability group, with the medium group falling between the other two. Because the majority of female subjects were in the low- or medium-ability group, and the low-ability group produced the greatest number of errors on the drawing test, the female group also had the greatest number of errors on the drawing post-test. When errors were analyzed according to sex of the subject, it was revealed that female subjects produced approximately twice the number of errors as male subjects.

Discussion

Analysis of the data did not reveal a statistically significant difference in effectiveness between the animated presentation and the non-animated presentation; therefore the null hypothesis cannot be rejected. Although the animated group achieved a higher mean score on the written post-test, this was not statistically significant, and there was not a relationship between treatment and performance on the drawing post-test. A discussion of results of the written and drawing post-tests follows.

Written post-test

The written post-test scores were generally high, ranging from seventeen to twenty out of a maximum of twenty. Evidently the instructional unit was successful in communicating concepts of perspective to most subjects. It is possible that testing for comprehension immediately after treatment increased the number of correct answers on the written post-test due to the short time interval between treatment and testing; if so, short-term storage and retrieval skills may have affected test results. Another possibility is the nature of the learning skills involved. Recall and application of verbal or written information is the type of performance most often required of college-level students, and subjects may have been more experienced with these skills than with visualization skills.

Drawing post-test

Drawing post-test results were mixed, with successful application of some concepts and unsuccessful application of others. Seventeen subjects produced at least one drawing error that indicated a lack of understanding or application of principles of perspective. The drawing post-test not only measured recall and application of intellectual concepts, but also required drawing performance. Perspective drawing is a complex process, involving motor skills and cognitive strategies, as well as the application of intellectual concepts. Improving performance on tasks of perspective drawing can be accomplished by developing motor skills, and in fact this is the method used in studio drawing courses. According to Gagne(1985), the most obvious feature of motor skills is that they improve with practice. In the case of drawing, hand and eye coordination is improved by practice, resulting in greater control over the appearance of the constructed image. The drawing process can also be described in cognitive terms, beginning with perceptual analysis of the original image as presented in the instructional unit, storage of the perceived image in short or long term memory, and finally retrieval of the mental image and reproduction in the form of a drawing. Errors on the drawing post-test may spring from any one or a combination of cognitive skills. The pretest would seem to measure the ability to accurately perceive the original figure, form and maintain a visual image in memory, and superimpose the mental image onto a complex visual configuration of lines in order to disembed, or uncover, the original figure. The skills and abilities measured by the pretest correspond to those required by the drawing process when phrased in cognitive terms, with the exception of reproduction of the figure, which involves motor skills.

Although the effect of changing points of view on perceived shape was demonstrated through the use of animation in the presentation, some drawing errors indicated a lack of comprehension of this characteristic of perspective. In order to improve effectiveness of the animated sequences, it may be necessary to explicitly model the process of attending to changes in form brought about by changes in viewpoint, for instance, by superimposition of the outline of the new figure over the previous one. Salomon (1979), Rovet (1974) and others have shown that changing points of view and visualization can be affected by exposure to motion pictures which model the mental skills involved. The fact that Salomon's theory -- that low-ability learners are better served by more explicit modeling of cognitive skills, and high-ability learners are best suited to less explicit depiction of cognitive skills --s was not supported by this study may mean that the modeling of skills in the presentation was not explicit enough to assist low-ability subjects. Another interpretation is that performance on the drawing post-test did not specifically require the rotation of an image or changing viewpoints, but could have been accomplished by the application of techniques of perspective drawing. The difficulty of low-ability subjects to transfer concepts or techniques is confounded by the new performance criteria involved in constructing a perspective drawing.

Results of the study have raised questions for further research. The most striking result is the sizable differential between male and female mean HFT scores and performance on the drawing test. The data indicates a relationship between scores on the Hidden Figures Test and performance on the drawing post-test. There was a correlation of high score with superior performance, low score with inferior performance, and medium score with average performance. (There was a relationship between high scores on the HFT and performance on the written post-test, but other ability groups did not show similar correlations.) Still to be determined is the reason for this apparent difference in achievement. If cognitive skills are involved, then it seems possible visual training might improve these skills, so that all students will be equally prepared to receive and reproduce visual information. There is a need for further exploration to discover the exact nature of the cognitve skills involved in the drawing process, and to apply this information to the development of programs to enhance specific cognitive skills in learners of all ability levels.

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The Use of Design and Pictures to Structure the Writing Process

Richard Sinatra & Jeffrey Beaudry
St. John's University

Pictures have been historically used by teachers to stimulate students' ideas and verbal expression. Posters, enlarged photos, illustrations, picture books, film strips, and slides have been used to introduce and develop concepts in content areas and to motivate oral and written discourse.

Teachers can structure the use of pictures or photographs in four major ways. First, they could intentionally photograph their own visual essays or they could arrange and rearrange any combination of slides or photographs in their possession to form a unified visual essay. Secondlv, the teacher, in conjunction with students, could plan for common theme photography during a traditional class outing. Third, visual essays can be prepared by students using single pictures and picture sequences from newspapers, magazines, books, and even their own snapshots. Fourth, students can make visual essays of their own through the viewfinder. This can be a most intellectually rewarding experience, especially when students learn to compose a theme and plan the parameters of shots before the actual photography.

The strengths of the latter procedure for the writing process stems from the planning, photography, and structuring of developed photographs students engage in prior to written expression. The nonverbal, visual activity of photography can both stimulate and organize verbal activity.

The present study investigated the use of such a structured visual approach on students' planning and execution for the writing of various discourse styles. The research question posed was straightforward. Would low literacy achivement students at the 6th and 7th grade levels show increased competence in different writing styles when they planned, photographed, and "story-boarded" photo essays as compared to situations when they merely wrote an assigned topic intended to elicit a particular writing style? A repeated measures design was used allowing for the effects of the photo essay approach to be measured for all the low-achieving youngsters.

METHOD

Subjects

Subjects in the study were 33 sixth graders and 36 seventh graders from a parochial school in the Williamsburg section of Brooklyn, New York. The study subjects were 85% Hispanic, 10% Black, and 5% Oriental.

The reading level of the sixth grade students ranged from 4.8 to the 5.2 grade level as determined by the Comprehensive Assessment Program, Achievement Series administered by the Diocese of Brooklyn, and the reading level of the seventh grade students ranged from the 5.6 to the 6.8 grade level as determined by the same test (Wick, Smith, Beggs, Braun, Nordstrom, Smith-Spiegel, and Stevens, 1980).

A composition written before the study was implemented revealed that the written competency levels of the two grade level groups were quite close. All students wrote a class composition on the topic, "A Day with My Family in Williamsburg." The Diederich rating scale (1974) was used by three raters to evaluate each student's composition. The sixth graders averaged raw scores of 10.6 for Mechanics, 14.2 for Content, and 24.6 for the Composition total. Seventh graders averaged 11.5 for Mechanics, 14.3 for Content, and 25.8 for the Composition total. Multiplying each score by 2 allows for percentages to be calculated. Thus the 6th graders were writing at about 49% competency for content and mechanics compared to a universal sixth grade population while 7th graders were writing at about 52% competency compared to the expectancies of seventh graders.

The pretest total scores for both grade 6 and 7 were compared using one-way ANOVA and showed no significant differences F(1,67)=0.534, p=0.47. In addition, the pretest total score was broken down into components, content and mechanics.

To further inspect possible variation in these groups, one-way ANOVA showed that the two groups did not differ significantly. For content, the results showed only a slight tendency toward a significant difference, F(1,67)=2.36, p=0.13., while the comparison of the mechanics pretest showed no difference F(1,67)=0.004, p=0.95. These pretest scores were nevertheless used as covariates in the subsequent analysis of treatment effects.

Procedure for Students

Because the content of the 6th grade Social Studies curriculum involved the topic of archeology, the general theme for most of the photo essays was "Wonderful Williamsburg." The photo essays provided a way to study archeology in a modern way - by using and photographing objects of an historical area of Brooklyn, N.Y. Secondly, because the students generally had problems in speaking and writing standard English, photo essays developed from their common environment provided a universal way to focus on language. The images and ideas captured by the photos transcended the language differences of this diverse student population while providing a common base for communication. Indeed, the "deep" structure of a picture is processed by a viewer for meaning regardless of his or her facility with the "surface" structure of language.

When either the sixth grade or seventh grade students used their cameras to collect their photo essays, they had to plan topics or themes, photograph pictures according to the particular assigned theme, organize their pictures after development according to an organizational plan for that theme, and then write a composition on the theme topic. Three theme topics were planned: one designed to elicit a sequential style of writing; one a descriptive style; and one, writing of classification.

The sixth graders followed the photo essay approach first. Over three two-week sessions, they planned, photographed, "story boarded", and wrote the three essays. The topic, "A Day with the Principal," was assigned to elicit a visual and written essay arranged in sequential, chronological order. The second essay, "Problems in Williamsburg", was planned to produce a general descriptive theme in which students photographed and wrote about the problems they witnessed in their local environment. The third essay, "Community Helpers," was planned so that students could categorize workers in their community and provide visual examples of what each worker did.

During the same time period, the seventh graders were assigned the same three theme topics for writing. In this case, they had little prewriting activities, other than the writing of the essay during class time when the essay was assigned.

The theme approaches were then reversed by grade level. When the seventh graders followed the photo essay approach, they planned, photographed, and wrote about the topics; "A Day at School," "How the Parish Helps the Community," and "Architecture in Williamsburg." These themes were once again, intentionally assigned to elicit sequential, descriptive, and classificatory styles of thinking. At the same time, the sixth graders wrote the three essays without the benefit of any previsionary experiences.

During each photo-essay treatment period, a good amount of time was devoted to planning what to photograph to fulfill each of the theme requirements. Students brainstormed the visualized ideas of the photo essay before actual photography. For instance, for the topic, "Williamsburg's Problems," students felt that wrecked buildings, abandoned cars, garbage in the streets, dangerous parks, and graffiti on signs and buildings contributed to an unhealthy environment. Working in groups of two students to a camera, they then were taken by their teacher into the environment to photograph their previsualized ideas. When the developed pictures returned some days later, the student pairs arranged the photographs as an organizational, story board chart. The title of the essay appeared on the 2' x 3' poster chart along with lines drawn between the pictures to show idea connections. Most students also wrote sub-headings for their pictures. The completed story board showed an overall visual schema for each discourse style.

Figure 1 shows the visual pattern of the three types of organization. Student groups at each grade level had differing numbers of pictures for each visual essay or for a category of information within the essay. For instance, some had three photos for the category "Abandoned Cars" in the Williamsburg's Problems essay while some had five or six photos.

Insert Figure 1 Here

Two additional essays were written at the mid-point and at the end of the treatments. Without the use of visuals all students wrote on the topic, "Transportation in Williamsburg" just prior to changeover of groups, and they wrote on the topic, "Ways to Have Fun in Williamsburg" at the end of the second treatment period.

Procedure for Raters

Three independent raters were used to evaluate each student's written composition. Nine papers were evaluated by each rater for each student. The score assigned to each student's paper was the averaged score for the three raters. The raters had received lengthy training in holistic scoring procedures, had participated as raters in previous writing research, and had achieved high interrater reliability using the Diederich Rating Scale (1974). Their interclass correlations as determined by the Shrout and Fleiss procedure (1979) was found to be .94 for fifth grade writers, .97 for sixth grade writers, and .93 for writers from third grade to high school.

The Diederich Scale was used to evaluate the written compositions for two major reasons. First the scale provides a holistic way to obtain measures of a student's "general merit" and mechanics performances of any composition. General merit is made up of weighted components given to ideas, organization, wording and flavor while mechanics is composed of weighted scores given to usage, punctuation, spelling, and handwriting. Secondly, and most important for the photo essay procedure, the components of ideas and organization are doubly weighted in value. Thus, ideas and organization are weighted on a scale from 2 to 10 while the other six components are weighted on a scale from 1 to 5. The raw scores of all eight components are added and the total is then multiplied by two to obtain a percentage score in writing competency. In terms of state requirements, New York requires that a graduating student achieve at least a 65% competency level in three writing tasks (University of the State of New York, 1980).

RESEARCH DESIGN

The statistical model was for one between subjects and one within-subject factor in a repeated measures design. Using the multivariate analysis of variance from the SPSSx (version 1.0), the between-subjects variable had two levels corresponding to the two groups, grade 6 as group A and grade 7 as group B. The within-subjects factor represented the time of measurement (e.g., first writing and second writing) of written competency for each of narrative, descriptive, and classification compositions. There were a total of nine measures of writing. Separate analyses were made for each composition type on two sub-categories, content and mechanics, in addition to total scores with the appropriate scores as a covariate in each analysis. Using the pretest scores as covariates, the means were adjusted for the covariate prior to entry into the repeated measures analysis of covariance. The basic assumption of analysis of covariance, linearity of regression of pre-test on posttest, was satisfied by the comparison of regression slopes.

RESULTS

Each of the major composition types - narrative, descriptive, and classification-was analyzed for total scores as well as for two subcategories, content and mechanics. The results of the repeated measures ANCOVA indicated two significant main effects out of the total of nine time-of-treatment outcomes. That meant that for the between-subjects factor of the group (i.e., grade 6 and grade 7) significant differences were found for student performance from the first to the second assessment. The two significant main effect results were from the analysis of variance of narrative essays. Interpretation of these significant main effects was confounded by the findings of significant interactions which are discussed below.

The analysis of variance for main effect results for the narrative essay scores were as follows: content, F (1,67) = 8.6, $p < .01$; for mechanics, F (1, 67) = 3.42, $p = .07$; and total scores, F (1, 67) = 6.04, $p < .05$. The descriptive essay scores showed no significant main effect differences for any of the writing comparisons - content, mechanics, and total scores. The analysis of variance for descriptive scores indicated the following: content, F (1,67) = 2.16, p = .15; for mechanics, F (1, 67) = 1.56, p = .22; and total scores, F (1, 67) = 0.05, p = .82. For scores from classification essays, the analysis of variance showed no significant main effect differences for any of the writing scores - content, mechanics, and total scores. The analysis of variance for classification essay scores resulted in the following: content, F (1, 67) = 0.35, p = .55; for mechanics, F (1, 67) = 0.60, p = .55; and total scores, F (1, 67) = 0.42, p = .52.

However, the follow-up analysis of the within-subjects factor, the time of treatment and group (e.g., pictures or no pictures) showed eight of nine comparisons to have significant interaction effects. Only one writing competency, the mechanics dimension of classification, did not show a significant interaction, but the null hypothesis was only rejected at the $p = .089$ level of significance. Anlaysis of interactions for narrative writing showed the following: for content, $F\ (1,\ 67) = 9.69$, $p < .01$; for mechanics, $F\ (1,\ 67) = 17.98$, $p < .001$; and for total scores, $F\ (1,\ 67) = 12.74$, $p < .001$. The separate graphs of the interactions for narrative writing are shown in Figure 2. For example, the results in Figure 2-a indicate that students in group A showed no apparent decline in writing performance from the first assessment when photo essays were used to the second assessment when students had no additional organizing framework. Students in group B, on the other hand, remarkably improved their scores from the first assessment, no photography and storyboarding to the second assessment, in which the photo-essay approach presumably accounted for a large improvemnt of writing performance.

Analyses of interactions for descriptive writing showed the following: for content, $F\ (1,\ 67) = 25.99$, $p < .001$; for mechanics, $F\ (1,\ 67) = 15.99$, $p < .001$; and for total scores, $F\ (1,\ 67) = 25.67$, $p < .001$. The separate graphs of these interactions for descriptive writing are shown in Figure 3. For classification writing the analyses of interactions showed the following: for content, $F(1,67) = 17.46$; $p < .001$; for mechanics, $F(1, 67) = 2.98$, $p = .09$; and for total scores, $F(1, 67) = 13.26$, $p < .001$. The separate graphs of these interactions for narrative writing are shown in Figure 4.

DISCUSSION

Note the consistency of results as they are depicted in the graphs, Figures 2 - 4. The groups had very similar patterns, with group A, the first group to get the treatment, maintaining a high level of initial performance with writing scores falling off when the photo-essay treatment was discontinued. Group B, on the other hand, consistently showed improved scores after using the pictures with the organizing framework in all but one of the writing measures.

While there is a consistent pattern of significant interactions for eight out of nine anlayses, interpretation of these results should be made with extreme caution especially due to the sample selected, the comparability of groups, the interaction of timing of measurement and treatment effects, and the novelty of the treatment. The sample was children routinely categorized as low-achieving, "at risk" students. It is expected that these students' scores will tend to show regression effects by improving their essay scores during the study. The use of the pretest scores as a covariate helps to correct for the effects of this tendency. However, the comparability of groups may even be a more critical issue. In spite of the statistical controls for the groups, such as homogeneity of variances and group comparison of pretest scores, data was not collected for nonparametric analysis of demographic variables such as sex, age, or prior achievement, which then makes generalization to a population of "at risk" students extremely tenuous.

While the data analysis followed a repeated measures design, a case could also be made that this study contains features of a time-series design. Since a total of nine measures were actually used as the dependent measures of composition skills, an alternative analysis of this extensive data set might have attempted to use a time-series anlaysis of the results. Another possible means of strengthening this type of study would be to take an additional measure of both groups as a 1-month or 3-month follow-up measure after they had been exposed to the treatment to verify transfer effects.

Finally, the structured photo-essay approach does represent a highly unique approach for the thinking and writing demands of composition development. This approach employs a recording medium with systematic observation. The final process of placing photographs in some conceptual order seems to have played a part in not only the creative, but the substantive outcomes of competencies in writing. The design of the study may have made it difficult to attribute the outcomes to the photo essay and structured design processes alone, but it is at least suggestive of further consideration. The writing process represents a critical nexus of competencies which seem to have been enriched by this approach. These are questions which can be addressed in future research of this seemingly promising approach to one of the most critical areas in the education of our children - the writing process.

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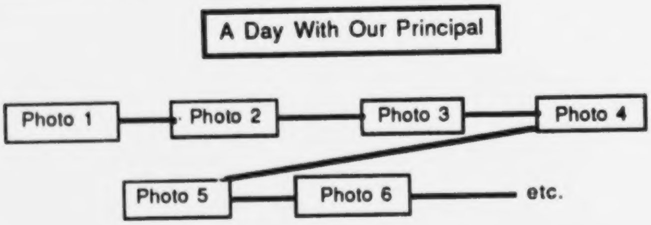
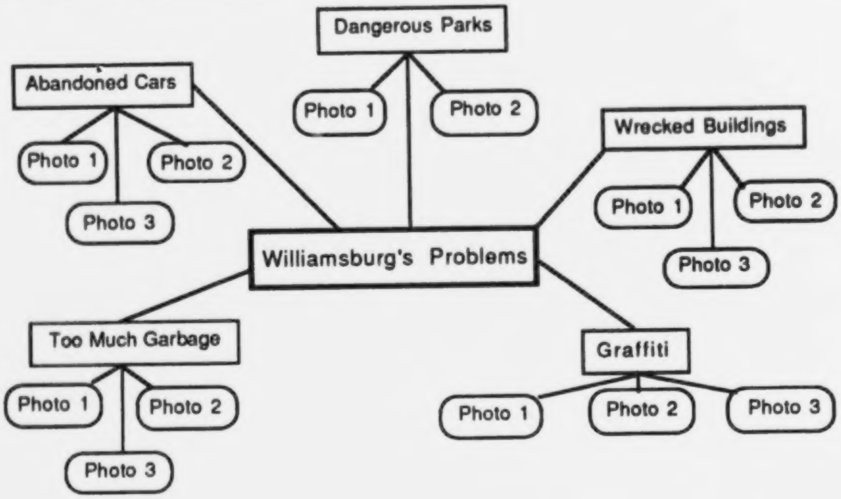
Figure 1: Essay Writing - Patterns of Organization

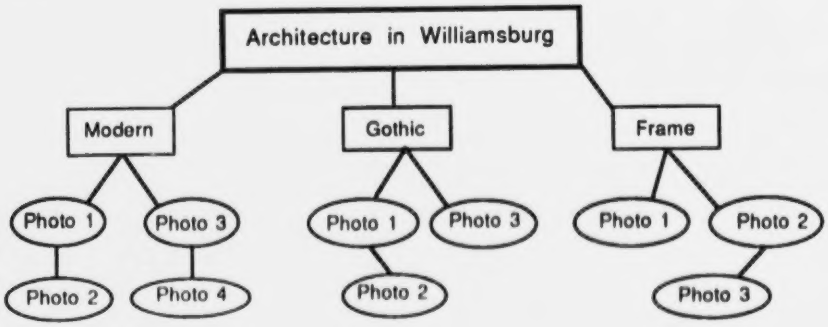
A. Sequential Organization


A Day With Our Principal
Photo 1
Photo 2
Photo 3
Photo 4
Photo 5
Photo 6
etc.

B. Thematic Organization


Dangerous Parks
Photo 1
Photo 2
Abandoned Cars
Photo 1
Photo 2
Photo 3
Wrecked Buildings
Photo 1
Photo 2
Photo 3
Williamsburg's Problems
Too Much Garbage
Photo 1
Photo 2
Photo 3
Graffiti
Photo 1
Photo 2
Photo 3

C. Organization by Classification


Architecture in Williamsburg
Modern
Photo 1
Photo 3
Photo 2
Photo 4
Gothic
Photo 1
Photo 3
Photo 2
Frame
Photo 1
Photo 2
Photo 3

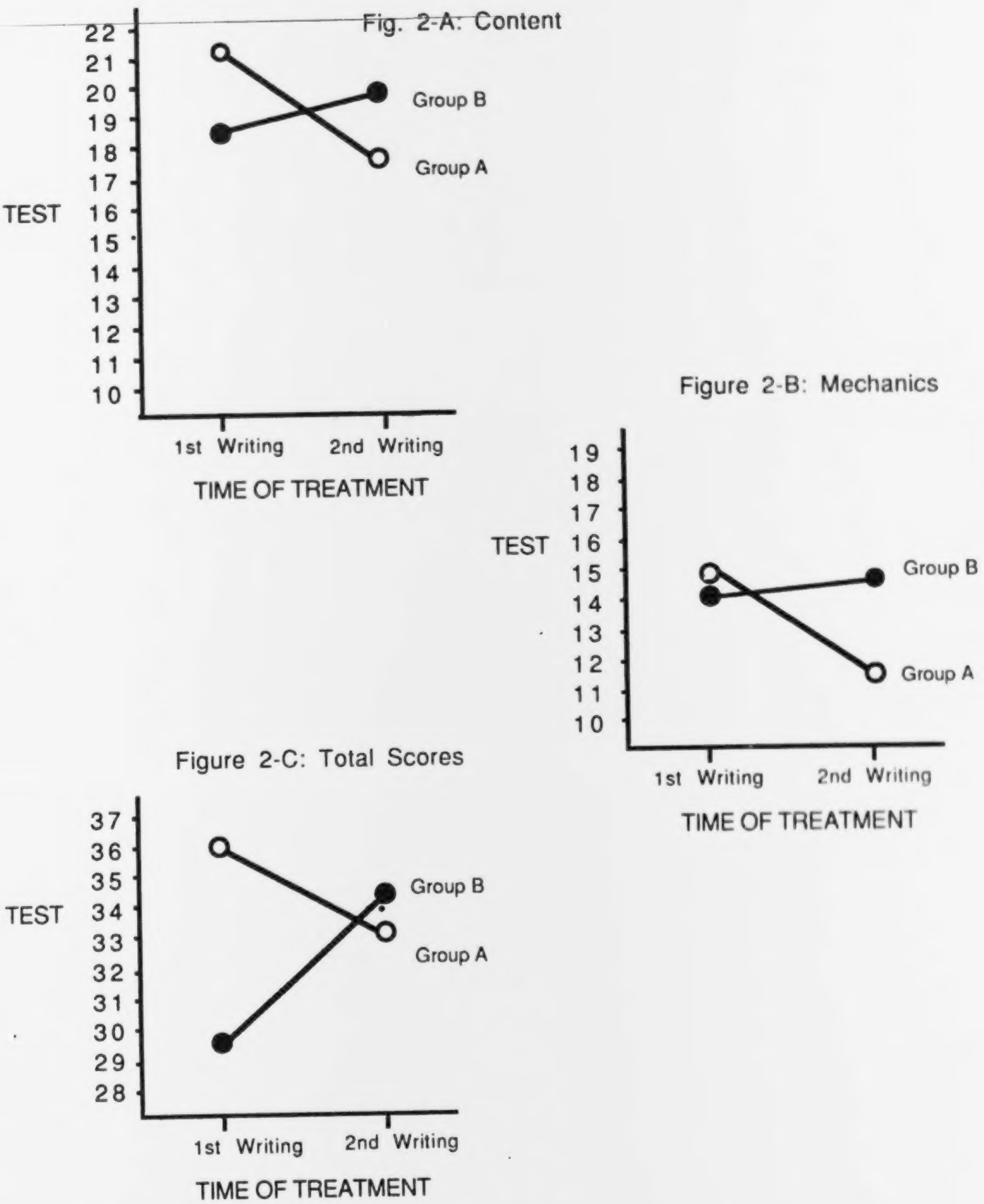


Fig. 2-A: Content

Figure 2-B: Mechanics

Figure 2-C: Total Scores

Figure 2: Interaction of Test by Time of Treatment for Content, Mechanics, and Total Score Using Diedrich Rating Scale on Narrative Writing.

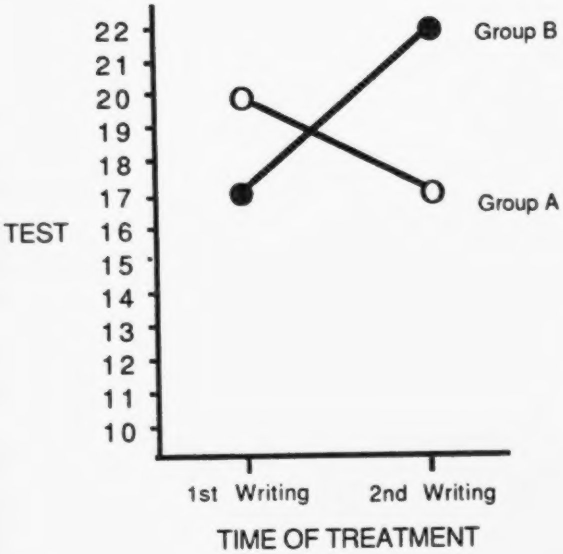


Fig. 3-A: Content

Figure 3-B: Mechanics

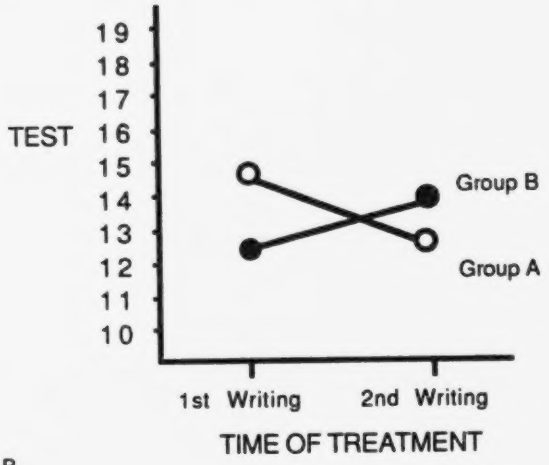


Figure 3-C: Total Scores

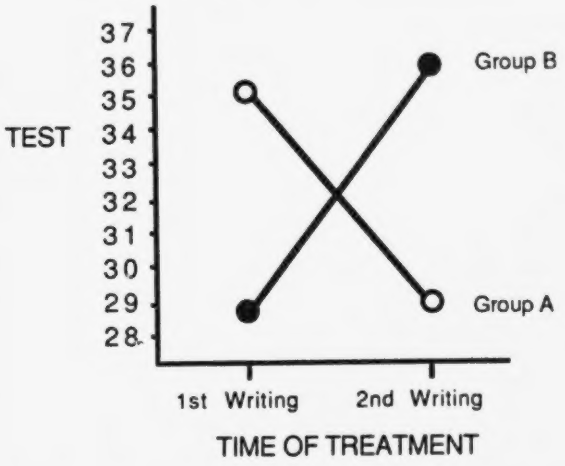


Figure 3: Interaction of Test by Time of Treatment for Content, Mechanics, and Total Score Using Diedrich Rating Scale on Descriptive Writing.

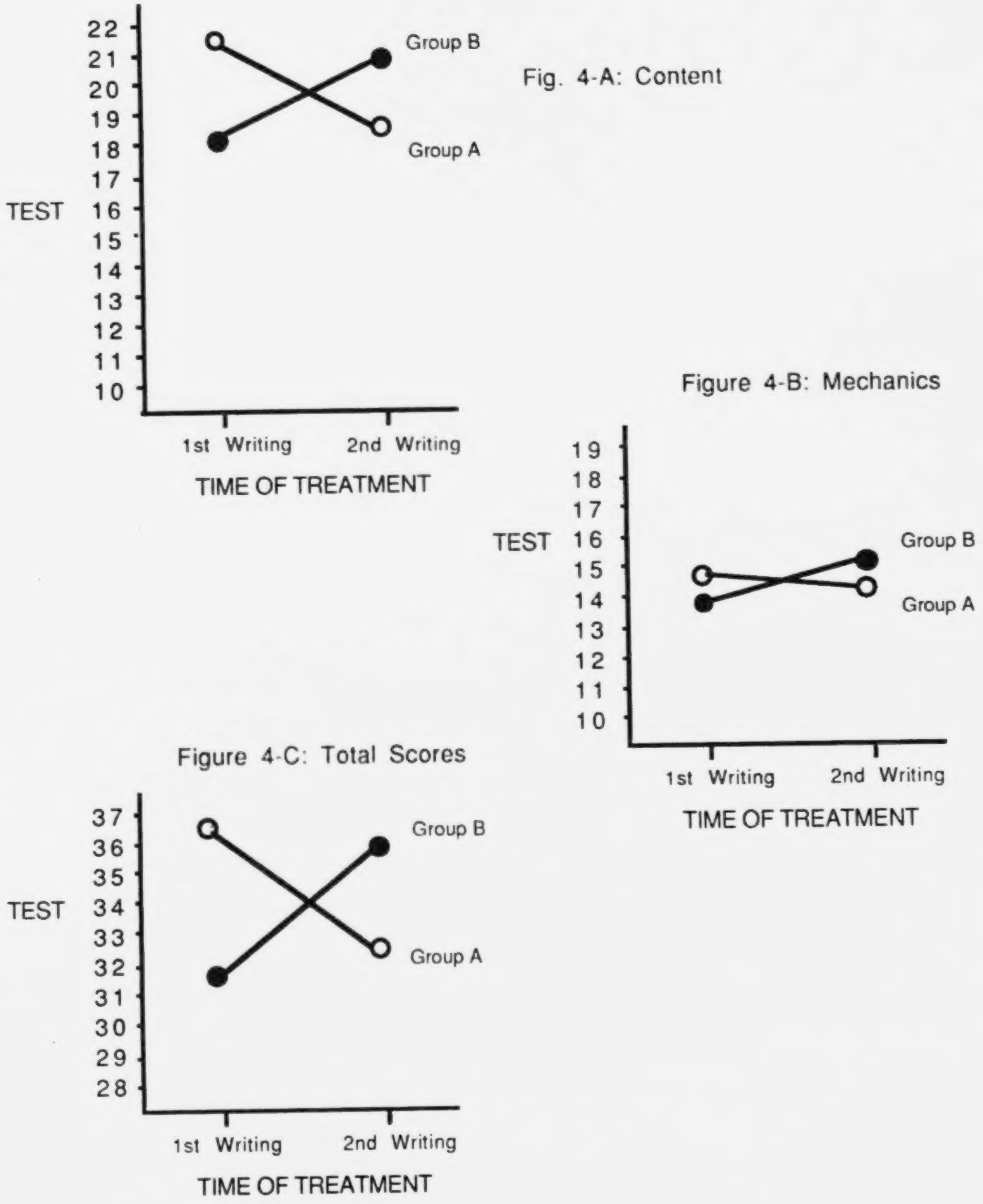


Fig. 4-A: Content

Figure 4-B: Mechanics

Figure 4-C: Total Scores

Figure 4: Interaction of Test by Time of Treatment for Content, Mechanics, and Total Score Using Diedrich Rating Scale on Classification Writing.

Designing Visual Analogies for Instruction

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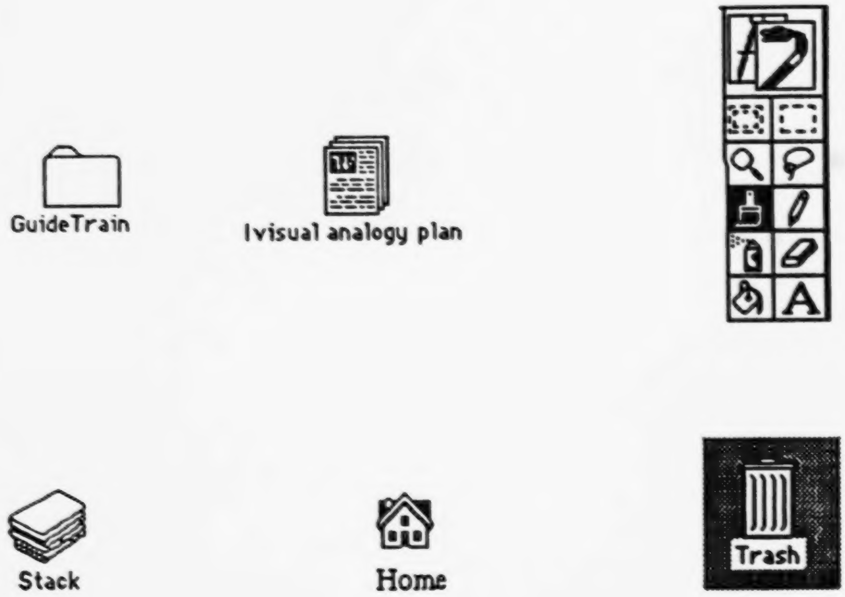
An analogy is a method for comparing sets of information which are similar enough to allow transfer of attributes across sets, usually from familiar to unfamiliar information. (Tierney & Cunningham, 1984). One of the critical characteristics of analogies is that the two sets of comparison, the known and the new, are quite unlike (Ortony, 1979), such as the comparison of the human eye and a camera, the atom and the solar system, or white blood cells and soldiers .

Typically analogies have the form: "X is like Y," where X is generally the unknown, to-be-learned, often abstract, information (white blood cells) and Y is the known, often concrete referent (soldiers). The unknown is often referred to as the **topic** and the known, the **vehicle** (Ortony, 1979; Verbrugge & McCarrell, 1977). The analogous attributes between the topic and the vehicle are often referred to as the **grounds** (Ortony; Verbrugge & McCarrell) and the differences, the **limitations** (Curtis & Reigeluth, 1984). The grounds which the analogues share may be based upon physical or structural similarity (atom and solar system), functional similarity (white blood cells and soldiers), both functional and structural (structure and function of cells compared to a factory [Curtis & Reigeluth]) or consequential similarity (solution of one problem using the principles from a dissimilar problem).

Visual Analogies

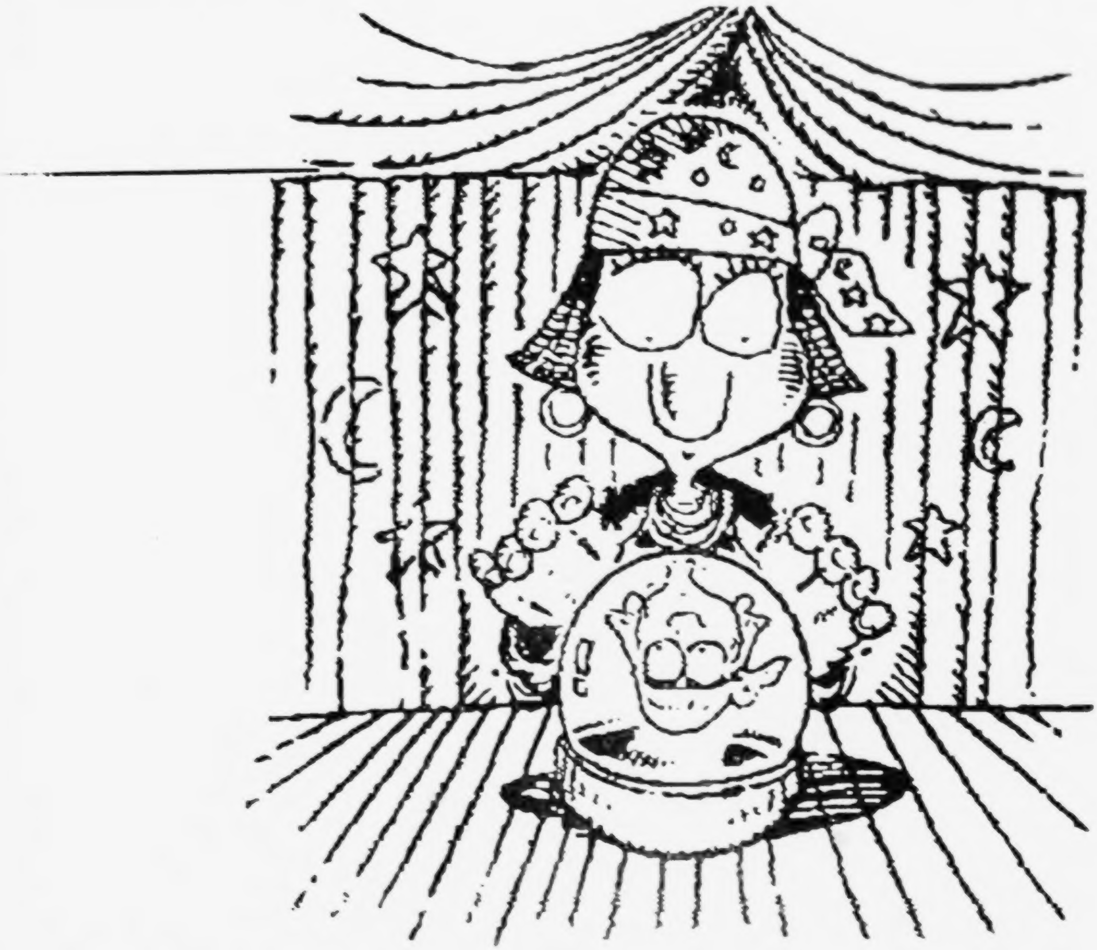
A visual analogy is a pictorial representation of the vehicle in an analogical comparison. As the vehicle is often concrete, the visual representation of it is generally relatively simple to develop. Examples of visual analogies are icons (see Figure 1) used in computer applications software.

Figure 1. Examples of visual analogies, icons used in MacIntosh applications software.


GuideTrain
lvisual analogy plan
A
Stack
Home
Trash

The illustration in Figure 2 is an example of a visual analogy used in teaching students a text processing strategy (Smith & Friend, 1987). Students were taught to use text structure to predict the contents of a passage in order to become more active readers. The illustration of the fortune teller was used to explain the strategy and the concept of prediction. It was also hoped that the visual analogy would promote retention of that step in the strategy.

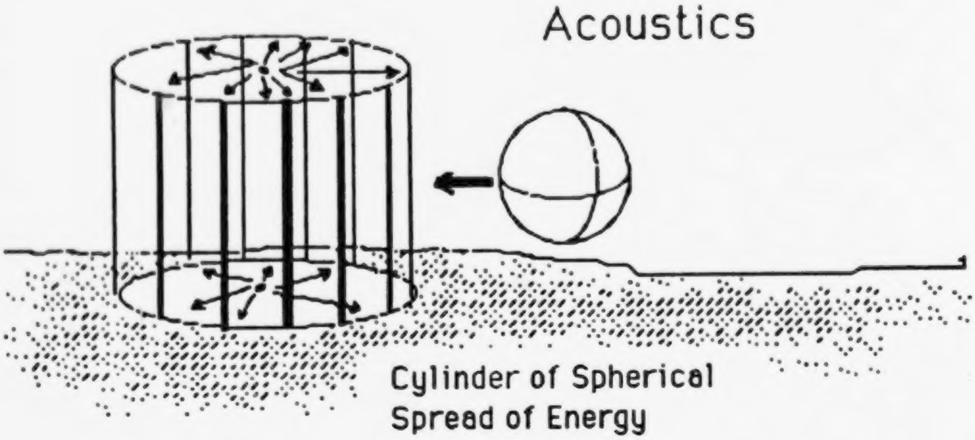
Figure 2. Analogical illustration used to explain prediction as a reading strategy.



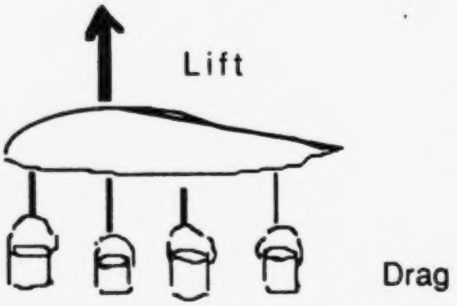
Visual analogies are often used to explain unfamiliar concepts as well. In Figure 3 the topics of acostic spread, how sound radiates from a source, lift in aerodynamics, highs and lows in meterology, and waves in physics are explained via visual analogies.

Figure 3. Visual analogies explaining a) acostic spread , b) lift in aerodynamics, c) highs and lows in meterology, and d) waves.

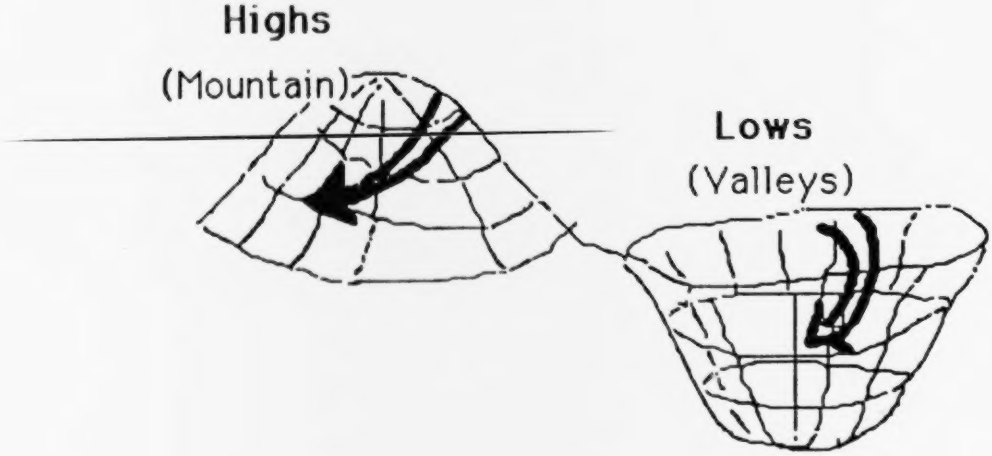
a)


Acoustics
Cylinder of Spherical
Spread of Energy

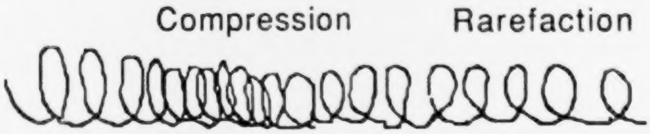
b)



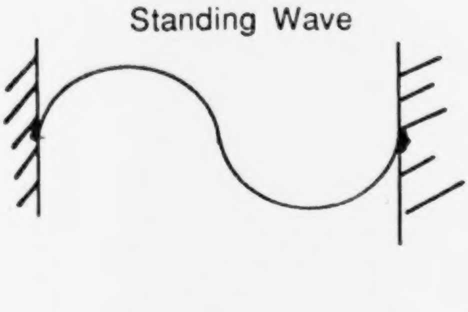
c)


Highs
(Mountain)
Lows
(Valleys)

d)


Compression
Rarefaction

Springs


Standing Wave

Strings

Visual analogies should not be confused with visuals that illustrate an example of a concept or principles as in Figure 4 or the diagrammatically illustrate in abstract form a concept or principle as in Figure 5.

Figure 4. Nonexample of visual analogy. This visual presents an example of the principle relating moment and force.

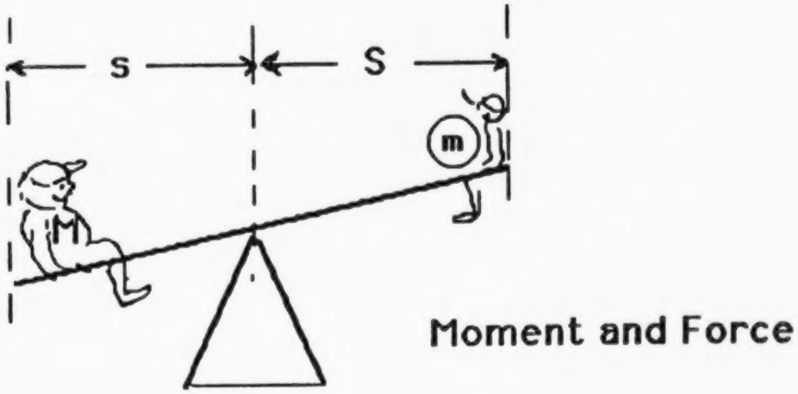
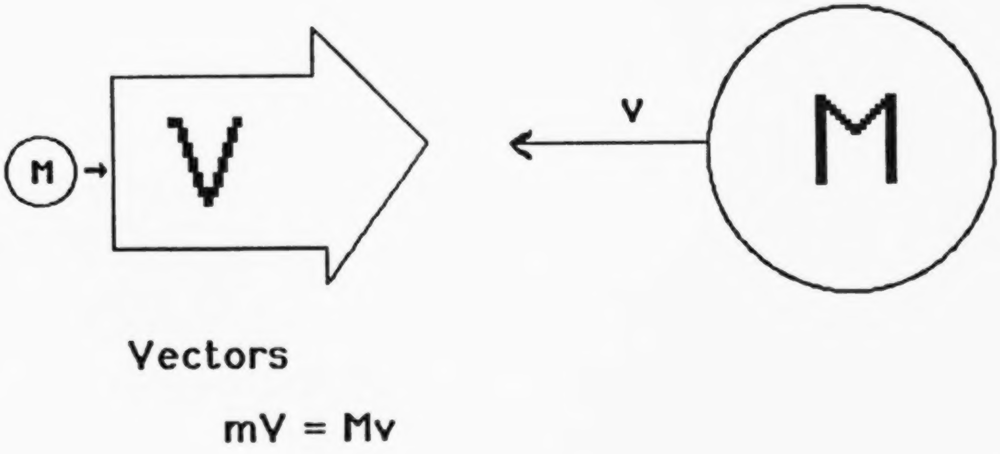


Figure 5. Nonexample of a visual analogy. Visual shows an abstract diagram illustrating the concept of vectors.



Visual analogies are hypothesized to support analogical reasoning by making the vehicle more concrete and recognizable (Alesandrini, 1984; Levie, 1987). In addition, the illustration of the vehicle may be constructed so as to emphasize the grounds of the analogy. Thus, the presentation of a visual in an analogy may increase the comprehensibility of the analogy. In addition, as with the provision of illustrations in other functions, an illustration may enhance the retention of the analogy, and consequently, the topic. Visual analogies may be superior to verbal analogies, as visual analogies "provide the visualization for the learner, while verbal analogies require the learner to provide his/her own visualization" (Reigeluth & Curtis, 1984, p. 108).

Visual analogies can be used to reinforce verbal analogies. In their analysis of 26 science textbooks, Reigeluth and Curtis (1984) found 216 analogies. Of these, 182 or 84% were verbal only, 34 or16% were verbal analogies reinforced with illustrations. Interestingly, there was a high load of visual analogies in only three of the 26 texts. Reigeluth and Curtis noted that two of these texts were chemistry texts targeted toward low ability students and the third was a elementary grade text that used many illustrations.

Very few studies have empirically investigated the effectiveness of visual analogies. However, a few studies could be located. In these studies visual analogies have been used to teach verbal information and concepts (Rigney & Lutz, 1976; Royer & Cable, 1976) and application of concepts (Curtis, 1986), principles (Beveridge & Parkins, 1987; Gick & Holyoak, 1983), procedures (Hayes & Henk, 1983, 1984), and multiple rules (Mayer, 1975).

The studies conducted by Royer and Cable and Mayer investigated the effects of verbal and visual analogies on learning. Royer and Cable's study investigated the effects of using a tinker-toy analogy to explain the internal structure of metals. Mayer used a series of verbal-visual analogies, such as a ticket booth, to explain the input, processing, memory, and output components of a computer. Both studies found that verbal analogies accompanied by visuals were superior to no analogies at all. Neither study, however, investigated the relative contribution of the visuals to the verbal alone, nor the factors in the visuals that contributed to the learning.

In the Rigney and Lutz (1976) study, college students learned information and concepts in the area of electrochemistry. Students were divided into two treatment groups: verbal analogy or verbal and visual analogy. The visual analogy group was found to be superior to the verbal group in recognition and recall in the categories of knowledge, comprehension, and application. In addition the visual group reported more positive attitudes toward the lesson. Unlike Rigney and Lutz, Curtis (1986) and Hayes and Henk (1983,1984) did not find that the addition of an illustration accompanying an analogy was more effective than the analogy alone. However, Curtis, upon analyzing qualitative interviews found that "the most enriched instruction was more beneficial to lower ability students; while the leanest instruction was more beneficial to high ability students" (p. 2). In her qualitative evaluation of the treatments through interviews she found that "illustrations associated with analogies tended to make them more memorable" (p. 2).

One of the most interesting series of studies with visual analogies were conducted by Gick and Holyoak (1980, 1983) and Beveridge and Parkins (1987). In these studies students were required to solve Duncker's (1945) radiation problem:

> Suppose you are a doctor faced with a patient who has a malignant tumor in his stomach. It is impossible to operate on the patient, but unless the tumor is destroyed the patient will die. There is a kind of ray that can be used to destroy the tumor. If the rays reach it all at once at a sufficiently high intensity, the tumor will be destroyed. Unfortunately, at this intensity the healthy tissue that the rays pass through on the way to the tumor will also be destroyed. At lower intensities the rays are harmless to healthy tissue, but they will not affect the tumor either. What type of procedure might be used to destroy the tumor with the rays, and at the same time avoid destroying the healthy tissue? (p. 230)

One of the solutions to the problem is to aim several low intensity x-rays from different directions so that they converge on the tumor. In their 1980 study Gick and Holyoak used verbal, analogical stories (such a general sending troops from several directions to converge on a fortification) to students prior to presenting the target problem in hopes that students would transfer the solution of dispersion of force. In a series of studies they found that students who were provided with the analogical story solved the targeted problem with a much higher frequency than students who were not provided with the analogy.

In the1983 study Gick and Holyoak investigated whether the presentation of a analogical diagram representing the principle of dispersion (six small arrows converging on a central point contrasted to one large arrow aimed at a point) would promote solution of the x-ray problem. Basically, they found that the visual analogy was not as effective as the analogical story. Surprisingly, the story plus diagram was less effective than the story alone.

Beveridge and Parkins (1987) were perplexed by this finding. After examing the diagram used in the study, they concluded that the "diagram was inadequate as a representation of the problem-solution schema required to solve the x-ray problem." (p. 231) They concluded that the attributes (grounds) that needed to be conveyed in the diagram were "(1) intensity difference, (2) summation at the focus, and (3) change in intensity" (p. 232) They constructed a visual analogue using six converging strips of blue transparent plastic which showed the change of intensity of color at the point of convergence. In a series of studies they found, in contrast to Gick and Holyoak's findings, that the visual analogy was superior to the verbal, story analogies that were used in the Gick and Holyoak stories. In addition, they compared the effectiveness of three visual analogies: Gick and Holyoak's pen-and-ink diagram, the colored-strips, and a more refined pen-and-ink diagram designed to illustrate the concept of summative intensity. They found colored strips to be most successful with 95% of the students solving the problem. Eighty-two percent of the students who received the refined, summative intensity diagram solved the problem, and only 62% of the students receiving the Gick and Holyoak diagram solved the problem. These treatments were compared to the verbal, story analogy that had a 75% success rate.

Beveridge and Parkins (1987) concluded that visual analogies may be superior to verbal analogies due to the absence of irrelevant cues that might detract from the discovery of the problem-solving principle. They concluded that the colored strips treatment was superior to the diagrams for two reasons: "(1) it does not require an understanding of diagrammatic conventions such as arrows and shading, and 2) its eye-catching quality [should] increase its imageability and consequent recall." (p. 235)

Suggestions for Designing Visual Analogies in Instruction

The empirical research investigating the effects and qualities of visual analogies is extremely limited. However, on the basis of research on analogies, including that on visual analogies, theory on illustrations in instructionl and theory regarding the cognitive mechanism of analogies, the following suggestions for the use of visual analogies are proposed:

1. Use visual analogies when
    a. it is uncertain if all members of the audience will have sufficient prior knowledge of the vehicle,
    b. members of the audience may be poor in mental imagery,
    c. members of the audience may have difficulty with analogical reasoning,
    d. in general, members of the audience may be described as low ability and/or poorly motivated,
    e. the grounds of the analogy includes a spatial dimension,

f. visual techniques may allow the emphasis of the grounds and limitations of the analogy, or
g. the vehicle may be difficult to explain in prose alone.

2. Caution should be taken in designing the visual analogy. The designer should carefully analyze the grounds and the limitations of the analogy and insure that the visual adequately represents these grounds and limitations.

3. Visual analogies should be subjected to extensive formative evaluation to insure that the members of the audience interpret the analogy as expected.

4. Visual analogies should be accompanied by a verbal description of the analogy.

Conclusion

Visual analogies may facilitate the learning of concepts, principles, procedures, and the solution of problems under certain circumstances. While research on analogies and illustrations may suggest some of these circumstances, further investigation is necessary to confirm these suggestions.

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An Experimental Visual Literacy Program in Schools

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Much has been written about visual perception, though it is accurate to state that the majority of such studies have been done under experimental conditions, while little attention has been paid to influencing in classrooms how students perceive.

The majority of art education programs at the elementary school level have been, until recently, studio-oriented, production programs that involve children primarily in making art, not in perceiving it. Recent efforts at expanding such programs to include looking with more insight are impressive, but probably not yet widespread in the schools (Eisner, n.d.; Duke, 1985).

Beyond such art education efforts, little is done in the elementary generalist classroom to influence perception of and language response to illustration. The ideas of visual literacy have had, to date, little effect on what classroom teachers do. Few regularly involve children in looking at pictures, both for the increased visual awareness which could result, and for the stimulus to language which pictures provide.

This paper reports on a study which attempted to explore how children respond to visuals, and how a program of visual literacy could enhance their oral and written response to pictures.

SCHOOLS

The two schools, one urban and one suburban, were chosen because they serve two quite different kinds of students. The urban school, in a low socioeconomic area, serves a large number of ethnic students. The ratio is approximately 55% black, Hispanic and Oriental, compared to 45% white students. The school enrolls both neighborhood and bussed-in students whose parents have sent them to the school because of its open education specialty.

The suburban school serves a middle class socioeconomic area in an independent suburban municipality, primarily neighborhood children, but also including a small number of minority students bussed-in to meet a court-ordered desegregation order. The minority population is less than 5%. There is no particular content or organizational specialty identified for this school.

THE PROGRAM

The program structure consisted on one lesson each week throughout the entire school year (September through June), including 35 minutes for the first, and 60 minutes for the fifth grades. Content was kept constant for the paired grades which sometimes, due to intervening programs, field trips and other interruptions, resulted in the same lesson being taught in different weeks. Classroom teachers chose either to stay or leave the classroom; as a generalization the two urban teachers were more often in the classroom during the lesson than were the suburban teachers.

The program content consisted of the illustrations in children's books, reproductions of artists' paintings, and principles or concepts developed therefrom. Children looked at, talked and wrote about, and made art based on these visuals which formed the core of the content. The program was organized to provide an introduction to visual elements like line, shape, color, form, space, dimension, and texture. It also introduced artists (like Picasso and Klee), illustrators (like Wildsmith and Sendak), and awards (like the Caldecott Medal). The program was pre-planned in a general way, though changes were made throughout the year, as a response to the children's positive or negative reaction to experiences with the visuals. Program content was presented to intact classrooms, though as noted below, data was analyzed from a subset of children involved.

Program content delivery in all four classrooms was done by this researcher, to minimize teacher variables. I was assisted in most of these sessions by a graduate student, and in some cases by the classroom teacher and a student teacher. These people did not present content, but served as small group discussion leaders in non-testing situations so that more talk could take place.

DATA GATHERED

Throughout the year we gathered data, in the form of oral comments made during group discussion, individual oral dictations taken in a "testing" situation, and individual pieces of writing done in the classroom during the lesson. While we did take some minimal dictation for first graders, neither school had an emergent literacy program, so children themselves were not able to do the extensive writing some authors have commented is indeed possible with young children (Klein, 1985). Thus, most of the first grade responses in this study are oral. Oral data, from both first and fifth graders, was taped and then transcribed, in each case by the same two research assistants used through the study, to ensure greater continuity of interpretation.

In contrast to the primarily oral first grade data, fifth grade data consists of about equal amounts of oral and written data, also analyzed by the same two assistants.

ORAL SAMPLES

Individual student response, in the form of oral comments tape recorded in a "test" situation, were gathered to examine the effectiveness of two different styles of painting as a stimulus for oral language fluency. This data was gathered at three times: beginning, middle and end of the school year to measure changes in response over time. In addition, we gathered data to determine if one style was more effective than the other in stimulating more language and more diverse language.

For each data gathering session there were two stimulus materials: 1) a watercolor painting by the American artist, Winslow Homer (1863-1910); and 2) a watercolor painting by the Swiss painter, Paul Klee (1879-1940). These were chosen to represent two distinctly different visual styles. In each case the Homer painting was the more realistic of the pair, presenting recognizable objects shown in three dimensional space, rendered in considerable detail, and in predictable colors. In contrast, the Klee painting was in each case an abstract rendering, not showing (except minimally) any recognizable objects, but rather flat shapes in two-dimensional space, done in arbitrary color.

Children came from their classrooms into the testing room in random order, chose one of the paintings, and dictated about it. The relative position of the paintings (i.e., left or right) was varied randomly between each child's dictation. All children took part in the oral dictation, though only data from a subset of 15 children in each classroom was actually used. At the beginning of the year each teacher was asked to identify 5 high, 5 average, and 5 low language users; these 15 children from each classroom (total N=60) provided data reported here. This research procedure is often used by language researchers (i.e., Dyson, 1984).

LANGUAGE MEASURES

To analyze the part of the data reported here, three different language measures were used; two of these are quantity measures while one is a quality measure. We analyzed the number of sentences generated, and the total number of words generated. These two quantity measures are often used as rough estimates of language maturity (Loban, 1976).

The quality measure, a type/token ratio, is often used by language researchers (Jensen, 1973) as an indication of language maturity. This reports the number of different words (called types) per given sample (called tokens). The researcher chooses the number of tokens to be used (in this case, 50 words) and then notes every repeated word. What is left is the type/token ratio, an indication of language diversity. For example, 25/50 is a less diverse sample than 36/50. The ratio is often presented as a percentage, as in the chart here.

RESULTS

Using these measures, we learned about three subsamples involved in the study: results were obtained through analyses of gender, setting, and grade level.

Table 1

Number of Sentences

	Homer							
	1st				5th			
	U	S	M	F	U	S	M	F
Beginning	20	19	17	10	9	9.9	6.9	12.4
Middle	6.9	5.0	6.0	6.8	7.8	17.2	8.1	14.9
End	5.3	25.5	10.4	7.5	6.7	9.8	7.3	10.3

	Klee							
	1st				5th			
	U	S	M	F	U	S	M	F
Beginning	14.1	14.8	6	17.2	10.0	8.0	14.0	7.0
Middle	9.9	14.1	16.1	8.6	6.6	9.0	6.0	8.8
End	9.6	10.0	7.4	12.0	9.4	10.5	7.6	11.5

Gender Differences

Females in first grade generated more sentences about Klee than about Homer. This was consistent over all three time periods. Females in fifth grade generated nearly twice as many sentences about Homer as about Klee during sessions one and two, but this evened-off during the last session. Males in first grade wrote more about Homer than about Klee in two of three sessions. Males in fifth grade wrote more about Klee than about Homer in two of three sessions.

Among neither males nor females at fifth grade was there apparent developmental progression toward more language, despite the fact there was no limit on the amount of time children could spend dictating.

The above data seem to suggest that as children grow older, boys move from preferring representational to preferring abstract art, while girls move from preferring abstract to preferring representational art.

Gender differences were also apparent in considering the number of words generated.

Table 2

Number of Words

	Homer							
	1st				5th			
	U	S	M	F	U	S	M	F
Beginning	104.5	140.8	133.5	82.8	92.7	119.5	80.1	134.5
Middle	54.2	65.3	53.5	73.5	96.8	198.3	93.6	180.7
End	37.0	250.0*	95.7	44.5	86.4	112.1	79.6	113.2
	Klee							
	1st				5th			
	U	S	M	F	U	S	M	F
Beginning	131.0	88.4	27.0	119.2	110.5	108.0	156.0	86.5
Middle	66.3	128.0	137.3	64.6	74.2	74.2	76.6	71.5
End	69.1	88.1	55.9	100.5	90.2	100.3	87.3	101.9

Females in first grade wrote more words about Klee in two of three sessions. In contrast, females in fifth grade generated more words about Homer than about Klee, over all three time periods. Males in first grade dictated more about Homer in two of three sessions. Males in fifth grade dictated more about Klee in two of three sessions.

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*Note: In this, and some other instances, there are 1 or 2 children whose scores are so completely out of range, that it skews the averages.

Therefore, findings about the numbers of words generated support the generalization above concerning the shift in preference as children grow older.

Table 3

Type-Token Percent

Homer

	1st				5th			
	U	S	M	F	U	S	M	F
Beginning	61.4	77.6	66.0	68.4	72.0	63.2	73.1	69.2
Middle	68.7	62.0	65.8	65.0	72.4	74.0	75.2	71.4
End	69.0	65.0	67.3	66.0	68.4	74.0	75.3	73.8

Klee

	1st				5th			
	U	S	M	F	U	S	M	F
Beginning	57.3	58.9	**	58.2	63.0	58.0	56.0	64.0
Middle	63.7	63.8	62.8	64.5	63.8	71.5	70.0	75.2
End	66.6	60.4	62.2	58.1	75.1	66.4	60.9	71.2

Looking at diversity in language, in all cases but one, the Homer painting stimulated more diverse language than did the Klee painting. In all cases for boys, both first and fifth grade, more diverse language resulted when the boys talked about the more realistic painting. In all cases girls in first grade dicated more diverse language for Homer, and in all but the second testing period girls in fifth grade also dictated more diverse language about Homer. Thus there seems to be a tendency for both genders to use more diverse language when orally describing more realistic pictures.

**No data included here because no 1st grade male said 50 words.

School Setting

Using pictures as a stimulus, we were able to examine urban and suburban differences, by adding the average number of sentences per testing period, and then averaging the totals. Using this process we found that suburban children, dictating about either Homer or Klee, generated both more sentences and more words than did urban children.

average # of sentences (Refer to Table 1)

Urban		Suburban	
Homer	Klee	Homer	Klee
9.2	9.9	14.3	11.0

average # of words (Refer to Table 2)

Urban		Suburban	
Homer	Klee	Homer	Klee
78.6	90.1	147.6	97.8

This contrasts with data about written language reported elsewhere which indicated that in three written samples about illustrations in children's books, fifth grade urban children wrote more words and more sentences than did suburban children (Stewig, 1988).*

Looking at language diversity, we find very little evident difference in these dictated samples, however. Calculating averages for urban and suburban samples, we find the following type/token percentages:

Urban		Suburban (Refer to Table 3)	
Homer	Klee	Homer	Klee
68.6	64.8	69.3	63.1

This finding confirms data reported elsewhere that the written language of urban and suburban students was comparably diverse.

The table also shows that both urban and suburban students dictated more diverse language about the more realistic, i.e., Homer paintings than they did about the more abstract, i.e., Klee paintings.

Grade Level Differences

First graders dictated more sentences about Klee than about Homer while 5th graders dictated more sentences about Homer than about Klee.

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*In reading this comparison, keep in mind that when transcribing oral into written data, the segmentation into sentence units is less certain than when working with original written samples. To try to compensate for this, we used only two transcribers.

Homer		Klee (Refer to Table 1)	
1st Graders	5th Graders	1st Graders	5th Graders
9.6	9.9	11.3	9.1

Comparing first and fifth grade sentence production, we notice that among those children who chose to dictate about Homer, the fifth graders dictated slightly more sentences. This was not the case among those children who chose to dictate about Klee. In this case, the fifth graders actually said 20% fewer sentences than did the first graders.

Analyzing the number of words spoken, fifth graders said more than first graders in either case.

Homer		Klee (Refer to Table 3)	
1st Graders	5th Graders	1st Graders	5th Graders
80.5	113.7	84.0	96.6

Fifth graders said more about Homer than about Klee, though the language production of first graders was quite comparable. Among those children choosing to talk about Homer, there was greater difference between first and fifth grade production than between those first and fifth graders who chose to write about Klee.

First and fifth graders dictated more diverse language when talking about Homer than when talking about Klee. Fifth graders dictated more diverse language than did first graders when talking about either Homer or Klee.

Homer		Klee	
1st Graders	5th Graders	1st Graders	5th Graders
66.4%	72.9%	60.6%	66.2%

Implications

Monitoring changes from first through fifth grade, we discovered a significant shift in preference among males and females, which occurred regardless of urban or suburban setting. Boys in this study moved from preferring representational art (Homer) to preferring abstract art (Klee). The opposite shift was noted among females. The question thus becomes: How can teachers allow boys to become more responsive to abstract art (the change noted) while not losing their earlier responsiveness to representational art? Conversely, is there some way that teachers can allow girls as they get older to respond to representational art, but yet continue encouraging response to abstract art noted among younger girls? The desired outcome is that teachers help children avoid narrowing their choices.

The shift noted in this study suggests that materials to be presented must include a full range from representational to abstract art. This should allow the developmental changes to occur, even as children continue to respond to earlier preferences. As teachers we need to avoid assuming that if we believe we know preferences we should present children with such materials. Rather, given the preference shifts noted, we need to consciously widen the range of what we include in a visual literacy curriculum. This guards against teacher bias about what teachers think children might prefer. This seems especially important given research from other areas of language arts which clearly document the difference between adult and child taste, i.e., in poetry (Terry, 1974). What we are doing is eliminating our own bias about kinds of art, in order to facilitate the full development of children's visual literacy.

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The Forgotten Typographic Research of Miles Albert Tinker

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Miles Albert Tinker was a professor of psychology at the University of Minnesota from 1927 to 1959. He pursued one of the most extensive inquiries into the effects of typographical factors ever conducted. His work is largely unknown for several reasons.

First, in his own time his results were presented in psychological journals and were not generally available to practitioners in the printing industry. Second, when practitioners were presented with Tinker and co-author Paterson's work in "How to Make Type Readable" (1940), they saw many "proofs" which they felt they already knew. They were insulted that psychologists who had little experience in their specialty presumed to tell them what procedures they should follow. Whittemore (1948) ridiculed attempts by researchers to study a field (typography) which was hundreds of years older than their own. He did not understand goals of science and resented an attempt to turn typography into a "formula".

Third, printers did not understand that Tinker and Paterson's work was focused exclusively on efficiency of processing by readers. This work did not presume to issue design rules. The goal was to establish factors which would allow most efficient processing by the least distraction of typographical factors during the reading process.

Today a new audience has been created by the explosion in desktop publishing and other computer mediated production. New users with no experience in design or selection of typography have choices available. Examples from the printing industry carry their own rules and terminology unseen and unknown by this new population. Designers of educational materials can profit most from Tinker's (and Paterson's) work.

The purpose of this paper is not to review Tinker's work due to the fact that it is simply too extensive. It is the purpose of this paper to make available a bibliography of Tinker's studies, with and without Paterson, and a list of factors studied from which others may select and pursue future research including Tinker's work as a resource.

The studies were conducted using the Chapman-Cook Speed of Reading Test. This test consisted of pairs of sentences. The second sentence contained one inappropriate word in the context of the first sentence, which the reader would select and cross out, signifying understanding. Scoring, aside from this check on comprehension, was by amount of material read.

Over half of Tinker's studies involving typography were co-authored by Donald Paterson, whose interests were aligned with those of present day instructional technologists. Tinker himself favored optimals of 10 point type, 19 pica line length and 2 point leading, but the range of acceptable variation found by Tinker and Paterson's investigations extended on both sides of these specifics. They found that type size such as 6 point and 14 point slowed readers down as did excessive line length (i.e. 40 picas) and material "set solid" (no white space between lines).

Although 4 point leading between lines was effective, they viewed those results from a practical standpoint, and recommended use of 2 point leading in order to save paper. This would not be a consideration in design of computer screens where "white space" does not result in increased paper costs. Another study applicable to computer screens relates to slant. Tinker found that reading was most efficient when the reading surface was perpendicular to the line of sight. Attempts to align one's sight with the screen surface in order to read more efficiently may account for present complaints of neck pain on the part of computer users attempting to adjust to reading a vertical surface.

Styles of type did not prove particularly significant except in the case of extremes such as Old English types. Interestingly, American typewriter was found to slow readers down about five percent, while its legibility was increased by viewing it from a distance.

Tinker also conducted studies of eye movements involving typography which revealed changes in fixation, pause duration and regression in response to changes in typographical factors. With poor typography, fixations became more frequent, pause durations longer and regressions more commonplace. These factors combined to slow readers down. Readers of these studies often thought Tinker was studying eye movements, when actually he sought demonstrations of change in reader function as a response to typography.

A third area of concentrated study was Tinker's work on illumination. He found that about 25 foot candles were quite sufficient, contrasted with those who proposed brighter lights. He made such recommendations as lighting the work area brighter than the surrounding area and not using high intensity bulbs which cause eye fatigue. This area of his work may have contributions for research on lighting of computer screens, though he studied reflected, not transmitted, light.

A check of Tinker's background and training revealed that he was trained at top institutions of his time with professors of the highest competance. His work was systematic, methodical, and consistant. While researchers today may wish to update methods, Tinker's work provides a model for modern investigators into parameters of type and practitioners are able to make choices as to typography with reliability as to reading efficiency.

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Field Articulation and the Design of Information for Microcomputers

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Background

For much of its history, education in this country has meant "school operations that were uniform in reflecting group norms" (Fantini, 1980, p. 28). Much of the research in education has been directed along the lines of finding the best method for delivering information to a normative group. The assumption was that there was one method that was best for all students. As a result, educational programs were designed for groups of students, such as a particular grade or age level.

In daily practice this required each student to adapt as best as he or she could to the educational method being used. Yet few people would deny that in any group of students there exists a wide range of differences in ability to handle information in a subject area. Those most successful at adapting to the instructional method being used advanced within the educational system, while those less able to make use of what the system offered often withdrew and/or were placed in special tracks.

Educators have long expressed dissatisfaction with this approach. In 1911, Edward L. Thorndike called for breaking away from this uniformity in order to design instruction better suited for the needs of the individual. This thinking was echoed by Carleton Washburne in 1925. In his introduction to the twenty-fourth yearbook of the National Society for the Study of Education entitled "Adapting the Schools to Individual Differences," he wrote:

> Throughout the educational world there has therefore awakened the desire to find some way of adapting schools to the differing individuals who attend them. (p. x)

To date, however, little progress has been made in designing and implementing instruction for the individual. Although educational reformers have introduced a variety of innovations,
most of these innovations have not dealt with individual differences of the students. The majority of these approaches have been comparisons between new "Method B" applied to all the students and existing "Method A." As a result new methodologies have seldom shown any real improvement in the educational process.

Individualizing Education

The concept of designing instruction for the individual rather than for a group has received renewed interest in the past two decades. Snow and Salomon (1968) state:

> If the variables used to stratify the group are well chosen, then at least the stage has been set for a new kind of intructional improvement, one based on the hypothesis that there is no "one best way" to teach anything (p. 343).

In 1980 Fantini wrote about the progress to date:

> The age-old fact that no two people are alike, that they have different needs, unique interests, talents, aspirations and problems, and learn in different ways has finally begun to penetrate the mainstream of our schools. Consequently, the school front has become the scene of a revolutionary struggle to alter institutional uniformity geared to group norms toward structures in which the individual uniqueness of the learner is given fuller play...
>
> Attempts to find one method that would reach 100 percent are fruitless... The point is that we are now at a stage theoretically and practically in which we should be able to generate the capacity to tailor programs to fit individuals. No one method can be considered superior to the other except as it contributes to the learning of the individual (p. 28, 30).

Ausubel (1968) defined perception as an awareness of an object or event prior to the cognitive processing of that object or event. Due to the amount of information to which people are exposed, perception must be selective. This selection is based upon their experiences, expectations, goals, values and other influences--in other words, their individual differences. People continually scan the available stimuli and select certain stimuli for processing. Exactly how a person scans a field and to what parts he/she pays attention is greatly influenced by differences within the individual. By looking at how individuals differ on certain variables, it may be possible to make predictions as to what parts of the environment they will process. By relating this information to learning, it then becomes feasible to apply it in the design of instruction.

The Study

This study attempted to relate an individual difference variable to one aspect of learning. The learning process used is the ability of the student to understand text information presented on a computer screen. The study employs the Trait-Treatment-Interaction or TTI methodology using field articulation as the trait.

This study follows the writings of several authors (Snow and Salomon, 1968; Glaser, 1972; Ingersoll, 1974; Di Vesta, 1975) who have suggested that the emphasis in research on learning should be on the cognitive processes of the individual working with a particular learning performance.

Both traits and treatments may affect, and in some cases will dictate, whether the receivers will attend, to what they attend, whether they will try to learn by rote or for understanding, whether they will form images or verbal statements, whether they prefer to use the visual over the auditory modality, and so on (Di Vesta, 1975, p. 189).

The TTI methodology was chosen because it allows the manipulation of one or more treatments in conjunction with traits of the participants. The results are intended to show how interactions between one or more of the treatments and one or more traits of the subject affect the outcomes.

Field articulation is used as the trait because it has been the subject of considerable study and a number of the characteristics identified with field dependent or field independent individuals appear to have a relationship to the learning process. Generally, field dependent individuals are governed to a large extent by the organization of the field. Field independent individuals are characterized by an articulated cognitive style. This type of person analyzes and structures experiences depending upon the task at hand and is not as easily influenced by a structure that is present. Neither end of the continum is clearly superior in concept attainment or other aspects of learning. Field dependence-independence is related much more closely to **how** people learn than to **how much** is learned.

A list of field dependent-independent characteristics that relate to learning include:

Field Independents	**Field Dependents**
1. Impose organization of unstructured field.	1. Take organization of field as given.
2. Sample fully from the nonsalient features of a concept in order to attain the relevant attributes and to form hypotheses.	2. Dominated by the most salient features of a concept in the attainment of the relevant attributes and in hypohypothesis formation. Can sample fully from set of features if they are in discrete form.
3. Utilize the active approach to learning, the hypothesis testing mode.	3. Utilize the passive approach to learning, the intuitive mode.
4. Learning curve is discontinuous--no significant improvement in learning a new concept until the appropriate hypothesis is found, then sudden improvement.	4. Learning curve is continuous--gradual improvement as relevant cues are sampled.
5. Use mnemonic structures and reorganize materials for more effective storage and retrieval of information.	5. Use existing organization materials in cognitive processing.

6.	Learn to generalize to object and design concepts more readily.	6.	Less effective in generalizations from from original design to variations on basis of common components.
7.	Prefer to learn general principles and acquire them more easily.	7.	Prefer to learn specific information and acquire it more easily.

(Thompson, 1987)

Fleming and Levie (1978) state that performance on a learning task is more rapid if the salient cues are relevant and less rapid if the salient cues are irrelevant to the learning task. Since field dependents tend to be dominated by salient cues, and ignore nonsalient cues, Goodenough (1976) hypothesized that when the salient cues are relevant, field dependents would learn the material at least as easily as field independents since they (field dependents) pick out the salient cues for processing. He further suggested that field dependents might learn the material more easily under these conditions due to their reliance on salient cues.

Witkin et al. (1977) found that field dependent people, who lack the ability to organize or structure information internally, are aided by materials that provide structure. The more structured the mediator the more that field dependent person's performance was helped.

A study using FDI and center and side headings as salient cues in printed instructional text (Thompson, 1987) did show an improvement in the scores for field dependent participants when the cues were present. In addition, field independent participants scored higher when using the text without the headings. This latter finding seems to indicate that the imposed structure interfered with the cognitive processing of the field independent participants.

Based upon this research, it appears plausible that FDI has an influence upon the way in which an individual gains information from his/her learning environment. A problem arises from the fact that the delivery system was printed text. This severly limits the amount of individualizing of instruction a teacher can do, if different versions of handouts must be generated within each group of students.

With the increase of newer technologies in the classroom, a possible solution to this logistical problem has presented itself. Restructuring information for individuals is a relatively simple task when using a microcomputer as the delivery system. Therefore, instructional text as presented on a microcomputer screen was chosen as the medium for distributing the instructional information. Specifically this study attempted to determine if the presence or absence of headings aids in the cognitive processing of the material as presented on a microcomputer screen.

Methodology

The participants in the study were classified on the individual difference variable field dependence-independence using the Group Embedded Figures

Test. Then the participants were divided randomly into two groups: one half received a selection of instructional text on a microcomputer containing key words used as center and side heading; the other group received the same selection of instructional text minus the center and side headings. After reading the instructional text, both groups completed an objective test covering the information.

A total of 47 undergraduate college students enrolled at the University of Wisconsin-Stevens Point during the fall semester 1988 completed the study. The age range of the students was 18 to 40 years. An undergraduate college population was chosen because the individual difference variables used here are relatively stable at this age (Wolitzky and Wachtel, 1973).

Hypotheses

Based upon the review of the literature the following hypotheses were developed:

1. There will be a significant difference between field dependent participants and field independent participants on scores of tests over instructional text with center and side headings and without center and side headings.
2. Field independent participants will score significantly higher than field dependent participants on tests over instructional text when the instructional text does not contain center and side headings.
3. Field dependent participants will score at least as well as field independent participants on tests over instructional text when the instructional text does contain center and side headings.

Statistical Analysis

The design of this study involved the use of two independent variables--field articulation, and the presence/absence of center and side headings in the instructional text, and one dependent variable--the score on a written test over the reading material. The statistic chosen to analyze the data was a two-way analysis of variance. The 2x2 matrix contained cell sizes ranging from 9 to 13. Nine participant responses were randomly discarded to produce a matrix with equal cell sizes.

The range of scores of the Geft was from 0 to 18. The median was 12.3. Those scoring below the median (0-12) were classified as field dependent and those scoring above the median (13-18 were classified as field independent.

The means for each cell of the matrix are:

	With Headings	Without Headings
Field Dependent	4.25	4.78
Field Independent	4.31	5.25

The two-way analysis of variance produced no significant findings at the .05 level. Based upon this study the hypotheses can not be supported. Although differences among the means were produce in the study, they are too small to indicate any relationship between the GEFT adn the article version as hypothesized. One possible explanation for this fact that is consistent with the literature review is the small size of the cells. A followup study with a larger sample size is in progress.

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Using a Visual Metaphor to Represent Command Language Syntax

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Abstract

Two studies investigated the learnability of the rules of a computer authoring language when presented in differing formats orders. A format based upon a visual metaphor was more effective than a flowchart, Backus-Naur Format, or text alone.

Introduction

More than twenty years ago Knowlton (1966) considered the dimensions upon which static graphics could vary. He proposed that visuals consist of three parts: elements, patterns of connection, and order of connection. Each of these elements could be represented in one of three ways: iconically, analogically, or arbitrarily. He further clustered pictures into three groups based upon their kind of elements. Pictures with iconic elements were classified as realistic, pictures with arbitrary elements were called logical and pictures with analogical elements were called analogical pictures. Knowlton pointed out that the classification of pictures depends on the use to which they are put and that a picture may be realistic or analogical depending upon the idea it is intended to represent.

In addition to classifying pictures, Knowlton suggested some uses for them. In particular, he believed that analogical pictures would be useful where the target content was intangible, either for physical reasons, or because it was abstract. Despite these seminal ideas, the bulk of graphics research has looked at the effectiveness of realistic pictures rather than analogical pictures (e.g., Dwyer, 1978).

Graphic Representation of Syntax

An instance of intangible content is the syntax of a command language. A computer command language is a tool for controlling the operations of a computer. Users must learn this language in order to interact with the computer. For simple languages it is possible to list the complete set of legal commands, but, as Chomsky (1965) showed, for any reasonably complex language a grammar must be written which defines all and only the legal strings of the language. The user must then learn this (or some approximation of this) syntax. Although there are potentially numerous ways to present the syntax to the learner, the explication of computer language syntax typically requires a meta-syntax which represents the structure of the target syntax to the learner (Bauer & Eddy, 1986). A meta-syntax is a code which is used to communicate another code, the computer language, to the user.

Bauer and Eddy (1986) used graphic meta-syntax (a flowchart) to represent computer language syntax and compared it to one kind of textual meta-syntax, Backus Normal Format (BNF). BNF consists of a set of meta-characters which are used to define the rules of the language. Subjects studied the rules of a command language and then judged the grammaticality of instances of rules. Graphic meta-syntax proved superior to textual meta-syntax by both an immediate and a delayed measure of learning to criterion. Error scores and response time were not correlated so there was no speed-accuracy trade-off. Error scores did not differ between groups after the initial study period, therefore a second experiment without any pre-study was administered. Again graphic meta-syntax was superior. The authors concluded that the superiority of graphic meta-syntax was due to quicker reference following errors. The authors also examined rule complexity as an independent variable and reaction time as the dependent measure. Graphic meta-syntax allowed quicker reactions regardless of complexity. In addition, there was a complexity by format interaction, with the graphic representation group producing comparatively fewer errors than the BNF group as rule complexity increased.

Isa, Evey, McVey and Neal (1985) in a similar study compared "Signs" with "Maps." Signs were essentially BNF, while Maps were a kind of modified flow chart. Maps produced superior learning for both programmers and non-programmers, but only when limited training was given. Maps were preferred by both groups.

Both of the above studies demonstrated a superiority for graphic representation of syntax, but neither addressed the problem of whether different types of graphics might have differential effects. Following Knowlton, intangible content may be represented either logically or analogically. Bauer and Eddy's flowcharts are logical graphics because the elements, geometric shapes, are not representative of any real thing. Isa et al.'s maps, as their name suggests, have a small metaphorical content. "Maps" are meant to resemble real maps. Isa et al. did not discuss this resemblance and apparently were not aware of Knowlton's distinction. However, given that both logical and mildly analogical graphics have proven to have some efficacy, I determined to compare logical and analogical graphics directly. Reasoning that analogies involve comparisons, and that if the comparison is to a well-known domain, the transfer of knowledge should result in superior learning. I therefore hypothesized that analogical graphics should be superior to logical graphics for presenting command language syntax.

Analogy, Metaphor, and Instruction

There is a long and voluminous literature concerning analogy and metaphor dating back to Plato and Aristotle. No standard distinction between the two exists, but it is generally assumed that analogies are more explicit and literal than metaphors. It appears that metaphors are a special kind of analogy; one in which the compared terms are not literally similar and in which the details of the comparison are not explicitly drawn. Because Knowlton's analogical pictures seem to me to be closer to metaphors and because the term metaphor is now widely used in computer software design, I will henceforth refer to visual metaphors when talking about analogical graphics.

Metaphors are considered (e.g., Richards, 1929) to consist of three parts: a topic, a vehicle, and a ground. In a metaphor such as "The mind is a computer." the topic is the mind, the thing being literally spoken of. Computer is the vehicle, or the known thing being used to illuminate the less-known thing, the mind. Finally, the inexplicit web of similarity is called the ground. Metaphors are often less explicit than the previous example, and in political seasons we often hear metaphors about "staying the course" or "throwing in the towel." As can be seen from these examples, metaphors are not an exotic phenomenon and Lakoff and Johnson (1980) convincingly demonstrated that everyday language is overflowing with metaphor.

In spite of the ubiquitous nature of metaphor, there is a tradition which goes back through Locke to Plato that literal language is to be preferred over figurative expression. This tradition may explain the relative emphasis on realistic or logical graphics to the exclusion of metaphorical graphics. In recent years, however, there has been considerable interest in metaphor and its instructional potential.

Much current research on metaphor in instruction stems from Ortony's (1975) proposal in which he advocated the educational benefits of metaphor. He cited three reasons why metaphors are helpful in education: they are vivid, they express the inexpressible, and they are informationally compact. The vividness hypothesis holds that metaphor presents information in a particularly concrete manner, thereby aiding retention. The inexpressibility hypothesis holds that some ideas which cannot be expressed literally can be expressed metaphorically. The compactness hypothesis holds that metaphors 'chunk' information, increasing communicational efficiency. An additional aspect of Ortony's thesis is that metaphor allows a transfer of meaning from something well-known to something less well-known. If we say that electricity "flows" we are saying that electricity can be thought of in terms of water, a more familiar domain. In fact, Gentner and Gentner (1983) investigated this metaphor and found differential cognitive effects as compared to a 'teeming crowds' metaphor.

One way of classifying metaphor theories is into two groups: subtitutionist and interactionist. Substitution theorists hold that a metaphor is just compact way of stating what could be expressed literally. Interaction theorists (e.g., Black, 1962) believe that metaphors can cause a restructuring of knowledge. Haynes (1975) and Johnson (1980) have interactionist positions on the relation between metaphor and comprehension. Haynes argues that metaphoric comprehension involves "... imaginative inference which is rule-breaking, non-rational, irreducible, gestalt, the emergent whole that is the discovery.... Metaphor...is the point at which concepts are modified" (p.277). Johnson holds that "... metaphors generate novel structurings of our experience in ways not fully anticipated by our available systems of concepts.... By causing a reorganization of our conceptual frameworks they institute new meanings" (p.65).

Ortony's position contrasts with the above in that new knowledge is presumed to be related to the old by assimilating it to an existing cognitive structure. Restructuring does not take place. Haynes and Johnson, however, assert that metaphors cause a restructuring of knowledge to express new relationships.

Metaphor and Learning from Text

If the first two of Ortony's (1975) theses, vividness and compactness, are true, then metaphors should have instructional value, even if they are not absolutely necessary. The mnemonic effect of concrete imagery and chunking is too well established to require further discussion. If metaphors are vivid or they chunk information they should have positive mnemonic effects. Pearson, Raphael, TePaske, and Heyser (1981) found that metaphoric sentences were recalled better than literals when placed in unfamiliar passages, although overall recall was unaffected. Reynolds and Schwartz (1983) however obtained contrary results. They found that metaphors placed at the end of prose passages were recalled better than literal counterparts and that overall recall was also improved. Reynolds and Schwartz's metaphors served as summarizers which may explain their better overall results. Hayes and Mateja (1981) found that metaphors embedded in text produce greater engagement than comparative organizers. Subjects who read a passage with embedded metaphoric allusions produced more inferences and less incorrect information than subjects given a comparative organizer first. Because this same result was found with entirely different materials in an earlier study (Hayes & Tierney, 1980) they argued that the effect is very reliable. Hayes and Meteja explained their results in terms of Mayer's assimilation theory of meaningful learning. According to Mayer (1980) there are three conditions for meaningful learning to take place: (1) the reception of new information, (2) an available familiar context into which to assimilate the new information, and (3) active use of this context. Hayes and Meteja pointed out that only condition three distinguished the metaphorical allusion from the comparative organizer since the other two conditions were satisfied in both treatments.

Other studies have found contrary effects. Yarbrough and Gagné (1987) and Becker and Carrier (1985) embedded metaphors in text and found no mnemonic effects. Both of these studies used numerous, unrelated metaphors to replace literal sentences. Yarbrough and Gagné acknowledged this limitation and cautioned that the results should not be generalized to indicate that the *systematic* use of metaphors would be ineffective. Indeed, it is a standard rhetorical rule that metaphors should not be mixed and the negative results of these studies may be interpreted as confirmation of that rule.

Most of the studies on metaphor have focused on verbal metaphor. However, the few researchers who have examined both visual metaphor and verbal metaphor have concluded that metaphoric ability is not modality specific. Kogan, Connor, Gross, and Fava (1980) stated that with older adolescents, "... Comparable cognitive processes seem to distinguish metaphoric operations in the pictorial and verbal domains" (p. 44).

A Metaphorical Notation

For the purposes of these experiments, a new notational standard, based upon an architectural metaphor was devised. The notation relies upon a system of walls, doors, rooms, and corridors to express the syntax of a command language. The notation has two overt conventions and one covert convention. The overt conventions are that one proceeds from left to right and that doors are one-way passages. The covert convention is that one cannot pass through walls. An additional convention used in these studies (in both the metaphorical and flowchart notations) is that literal keystrokes are represented in upper case characters, while variables are expressed in lower case characters. In its present form, the notation cannot express control structures, but this is not usually a defect because command languages typically do not allow control structures.

Figures 1 through 5 are some examples of how fundamental structures are expressed in metaphorical notation.

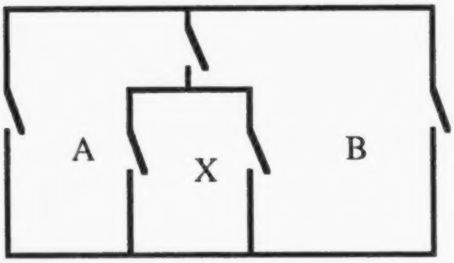


Figure 1 Optional Choice

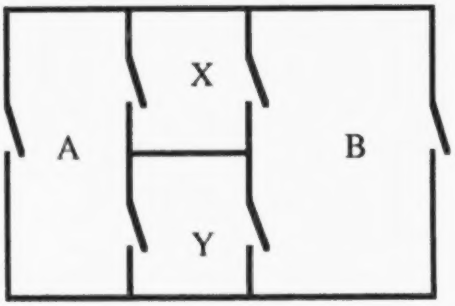


Figure 2 Forced Choice

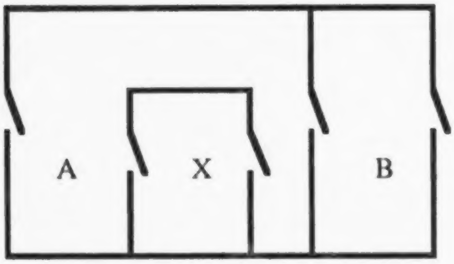


Figure 3 Optional Iteration

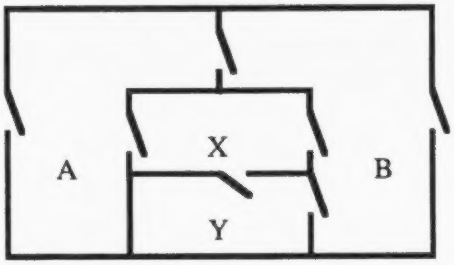


Figure 4 Nested Option

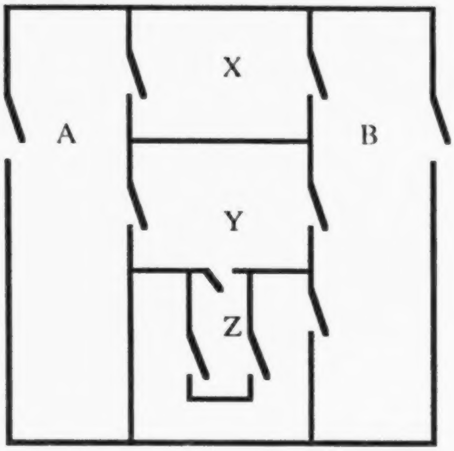


Figure 5 Nested Option with Iteration

Experiment 1

Method

Subjects were asked to learn four rules of the Superpilot lesson text editor. The four rules were, Jump, Delete, Find, and Replace. Treatments were administered on six Apple //e computers. After a short introduction subjects were given a three sentence overview of the set of rules to be presented along with a three sentence explanation of the form of the rules. Explanations were kept terse to determine to what extent the subjects could independently induce the meaning of the rule representations. Subjects were told that they would see a representation of a rule and an instance of that rule and that they should judge the instance legal or illegal. Subjects were informed that approximately half the instances would be illegal. (In fact, exactly half were illegal.) After answering, subjects rated their confidence from 1 to 5, with 5 being the highest rating. Immediately upon entering the confidence rating, feedback appeared, indicating whether the previous answer was correct or not. Subjects could study their answer and the visual display until they were ready to continue.

Subjects

Subjects (n = 54) were drawn from a pool of students enrolled in an undergraduate educational psychology course. A short explanation of the study was given before subjects volunteered, but no mention was made of a monetary reward until immediately previous to the treatment. Subjects were randomly assigned to treatments.

Materials

Software for the first two phases of the experiment was written in BASIC on Apple™ II computers. Graphics were produced using the MousePaint™ editor and were presented in black and white. Text was presented using the bottom four lines in eighty column mode. All subjects did the study on identical Apple IIe computers.

Lesson Versions

The lessons were identical with two exceptions. First and most importantly, the graphics were different. Three representations of each rule were created using BNF, a flowchart, and finally an architectural metaphor. Subjects in a given treatment saw only one of the three possible representations. The second difference in the treatments involved the introductions which explained the graphic notation. To the greatest extent possible these explanations were kept similar in length and detail.

Dependent Measures

The dependent measures were number of correct responses (with a maximum of four per set of instances), answer response time, confidence rating, confidence response time, and feedback reading time. Response times were measured in program loops, with fifty loops approximately equal to one second. Confidence ratings ranged from 4 at a minimum to 20 maximum (summed over four instances).

The eight-question posttest was scored in the following way. Subjects were given five points for each question and points were subtracted for errors. One point was removed for each incorrect insertion or deletion. Two points were removed for each order error. However, if the primary character (e.g., J for jump) was present at least one point was awarded. It should be pointed out that the words *jump, delete, find*, and *replace* were not used in the problem statements.

Procedures

Subjects read a short explanation of the purpose of the study, which also informed them that there was a prize for high scores. A reward of five dollars was offered to the three highest scorers and the next five highest scorers were offered one dollar each. Although the software contained an explanation of the procedures, based upon experiences in a pilot study it was decided to give each subject a short oral introduction. The experimenter explained briefly what the subjects would see and how they should respond. Additionally, all subjects were told that the content was quite difficult in places and that they should not become discouraged but should continue answering as best as they could. Subjects were in no way informed that part of the experiment would require them to make judgments from memory. Upon completion of the online part of the study, subjects were given a short written test. The test consisted of eight problems which required the subjects to write a string of symbols to accomplish some goal. No time limit was enforced.

The online part of the study consisted of five blocks of problems. Each block contained four probes for each of four rules. Two phases of the experiment were overlapped in this part of the study. One phase was the normal condition with graphic or textual representations visible. The other phase was a recall condition. This condition, which consisted of the third and fifth blocks of problems, was presented without any graphic or textual representation. These recall blocks were unannounced.

Results

Full model

The data from the first two phases of the experiment were first analyzed in an overall MANOVA with five dependent measures: score, response time, confidence, time to rate confidence, and time to read feedback. The independent variables were Group, Rule and Block. Significant effects were found for Group, Rule, Group by Rule, Block, and Rule by Block at the alpha = .05 level. Only these effects were considered non-random in further analysis.

Table 1 Means and Standard Deviations

Visible Condition	m	sd
Metaphor	2.94	1.05
Flowchart	2.67	1.05
BNF	2.41	1.04
Recall Condition		
Metaphor	2.51	1.08
Flowchart	1.97	1.01
BNF	2.13	1.14
Post Test		
Metaphor	30.00	6.19
Flowchart	21.61	12.07
BNF	21.33	12.92

Visible Condition

F-tests were calculated for the between-subjects factor (Group) and the contrast between the metaphorical condition and the other two groups. Only the dependent variable, score, produced significant effects, $F(2, 51) = 4.32$ and $F(1,51) = 6.66$ for the contrast. No further analysis of the other four dependent variables was pursued. Using the SAS procedure for repeated measures designs, a MANOVA was calculated by first transposing the data and entering Group as the independent (or between-subjects) variable and Rule and Block as the dependent (or within-subjects) variables. The MANOVA produced significant effects for Group, Rule, Block, Group-by-Rule, and Rule-by Block, all of which had previously been found to be significant by the full model. The univariate follow-up for Group produced an $F(2,51) = 4.32$ ($p<0.0185$), identical to the result of the previous univariate test, as would be expected. The univariate tests of Block, Rule, Group by Rule, and Rule by Block were all significant even when corrected for possible violations of compound symmetry.

Recall Condition

F-tests were calculated for the between subjects factor (Group) and the contrast between the metaphorical condition and the other two groups. Only the dependent variable, score, produced significant effects, $F(2, 51) = 5.37$ and $F(1,51) = 9.82$ for the contrast. No further analysis of the other four dependent variables was pursued. Using the SAS procedure for repeated measures designs, a MANOVA was calculated by first transposing the data and entering Group as the independent (or between-subjects) variable and Rule and Block as the dependent (or within-subjects) variables. The MANOVA produced significant effects for Group, Rule, Block, Group-by-Rule, and Rule-by Block, all of which had previously been found to be significant by the full model. The univariate follow-up for Group produced an $F(2,51) = 5.37$ ($p<0.0077$), identical to the result of the previous univariate test, as would be expected. The univariate tests of Block, Rule, and Block by Rule were all significant even when corrected for possible violations of compound symmetry. Rule by Group was not significant.

Speed Accuracy Tradeoffs

To test for speed accuracy trade-offs two statistics were calculated in both visible and recall conditions. Pearson correlation coefficients between scores and answer response times were non-significant for all three groups in both conditions. Additionally, a rate of acquisition score was obtained by dividing score by total time for each set of four questions. This rate score was then entered into a F-test contrasting the metaphorical group with the other two. The metaphorical group had a significantly greater rate of acquisition in the visible condition (F = 4.84, p<0.0323) but not in the recall condition (F = 1.98, p<0.1655).

Post-test results

The post-test scores were analyzed with a 3 x 4 repeated measures design using Groups as the between-subjects independent variable and Rules as the within-subjects variable. The multivariate test of Rule was significant but the interaction was not. Univariate follow-ups showed that Groups and Rules differed significantly (*F* =3.73, p<0.0307 and *F* =2.98, p<0.0333, respectively). The Newman-Keuls follow up test on groups showed that only the group exposed to the metaphorical notation differed significantly.

Discussion of Experiment 1

This experiment directly compared flowcharts, BNF, and visual metaphors. The metaphorical notation produce significantly higher scores on tests of interpretation, recall, and usage. No significant differences were observed for response time, confidence, time to rate confidence, and time to read feedback. In addition to the significant effects due to notation, significant effects were observed for rule and block and interactions. These effects may be explained as the normal results of practice and the differential effects of rule difficulty. The interactions reported all involved the four rules of the text editor. This factor was included because it is obvious that all rules are not equally easy to learn under various conditions. The reasons for these interactions may be due to inconsistencies in the structure of the rules which lead to learning interference. The following experiment addresses this question by comparing sets of rules of differing consistency under conditions similar to the present study.

The superior learning detected with the metaphorical notation could not be attributed to greater time being devoted to learning that notation. Tests of elapsed time and efficiency showed either no difference or an advantage to the metaphorical notation.

Experiment 2

Method

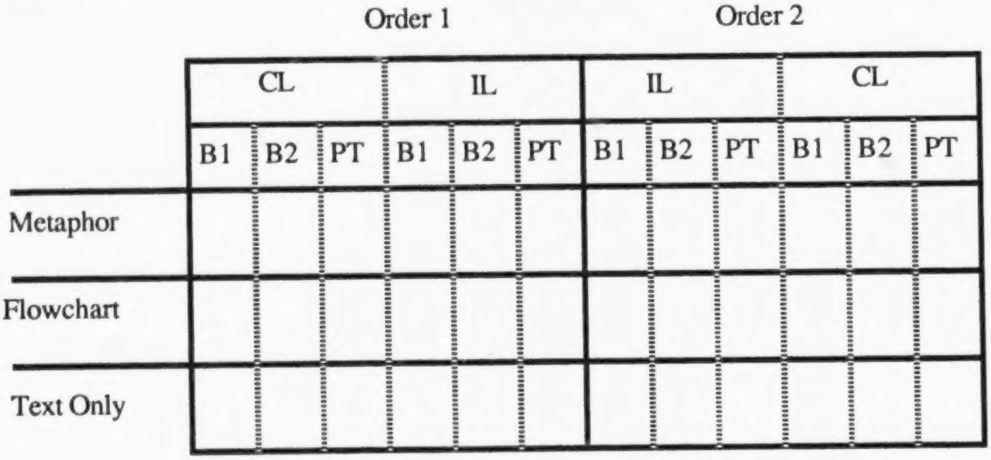
Subjects were asked to learn four rules of the Superpilot lesson text editor as above and four new rules designed for the purposes of this experiment. The new rules comprised a more consistent language than Superpilot. The means for determining the consistency of the languages is beyond the scope of this paper but interested readers may consult Payne and Green (1986). The experiment was administered on Macintosh SE computers. This experiment differed from the previous one in several important ways. First, the BNF treatment was deleted and a textual explanation was substituted. Subjects receiving graphic support also received the textual explanation of the rules. Subject were asked to generate commands after viewing prompts. Two blocks of practice prompts were presented, followed by an unaided posttest. Two command languages were presented in succession. Subjects were given feedback during the practice problems which included the correct answer after three incorrect attempts. No feedback was given during the posttests.

Subjects

A sample of 78 university students was recruited from introductory educational psychology courses and were similar to the subjects in the first experiment. Participation was voluntary. A short explanation of the study was given before subjects volunteered. Subjects were randomly assigned to treatments.

Research Design

As illustrated in Figure 6, a 3 x 2 x (2 x 2) factorial design was used. The completely crossed between-subjects factors were representational format and language order. The three levels of format were text, text plus flowchart, and text plus visual metaphor. The two levels of language order were inconsistent language first or the consistent language first. The two within-subjects factors were language and problem block. Two factors, language order and problem block, were entered to increase the power of the design (Glass & Hopkins, 1984). Language order was considered a factor although no hypotheses were formulated for this factor. Problem block was entered because it is normal that students should improve with practice. The other within-subjects factor was language with the two levels being the subset of SuperPILOT rules and the newly designed language.



	Order 1						Order 2					
	CL			IL			IL			CL		
	B1	B2	PT	B1	B2	PT	B1	B2	PT	B1	B2	PT
Metaphor												
Flowchart												
Text Only												

B1 = Block 1
B2 = Block 2
PT = Posttest
CL = Consistent Language
IL = Inconsistent Language

Solid lines indicate between-subjects factors.
Broken lines indicate within-subjects factors.

Figure 6 Research Design

Materials

Software for all treatment levels was written in HyperCard on Macintosh computers. Navigation through the materials was constrained by the software and subjects were naive about the nature of the software environment.

Treatments

Two languages, consistent and inconsistent, were presented in differing formats. The formats were Text Only, Text with Flowchart, and Text with Metaphorical Notation. The two factors, language and format, were completely crossed with formats being a between-subjects factor and language a within-subjects factors. To compensate for language order effects, the order of language presentation was counterbalanced: one-half the subjects receiving the inconsistent rules first and the other half receiving the consistent rules first.

Dependent Measures

Dependent measures were posttest correct answers, total mistakes, total failures (after three attempts), total time, Time 1 (elapsed time from the presentation of the problem until the onset of the answer), and Time 2 (elapsed time from the presentation of the problem until the completion of the answer).

Posttest Correct Answers

A total 12 correct answers were possible on each of the two posttests. A correct answer was recorded for each answer which matched exactly the intended answer.

Mistakes

A mistake was counted each time an answer to a practice problem was entered which did not match exactly the correct answer. Mistakes were summed over the 12 problems presented per block. Since a maximum of 3 mistakes were possible per problem the total number of mistakes could range from 0 to 36. Mistakes were not necessarily proportional to correct answers since zero to two mistakes were possible before answering correctly.

Failures

A failure was counted whenever the student could not answer a practice problem correctly in three tries. Total failures were the complement of total correct answers since a correct answer implies that there was no failure. While both mistakes and failures were sensitive to the relative difficulty of the differing formats and languages they returned different information. A significance difference for failures would indicate that some treatments were more helpful in recovering from errors.

Total Time

Total time was measured from the time the first information frame was displayed until the completion of the last posttest problem. Time was measured by the software in units of 60ths of a second. Since Total Time included time spent answering as well as time recovering from errors it offered a test of the overall efficiency of the different treatments. More reading time for feedback in the metaphoric condition, for example, would tend to indicate that subjects found a particular representation more understandable, *provided that* fewer errors were recorded in that condition. In other words, longer feedback reading times would indicate that subjects felt it was worthwhile to study the graphics. On the other hand, longer reading times with more errors would only indicate that that condition was more difficult to interpret. Note that Total Time did not equal Time 1 plus Time 2.

Time 1

Response Time 1 was measured from the first display of each problem until the onset of the answer. The elapsed time was measured in 60ths of a second by the software. This measure offered a test of speed-accuracy tradeoffs because low elapsed times combined with errors would indicate that a particular treatment was deceptive in some way.

Time 2

Response Time 2 was measured in the same way as Time 1 except that it was terminated by the student indicating that the answer was complete. Because the two languages did not necessarily require the same number of keystrokes the results of this measure would be equivocal if the Consistent Language required more time to answer. Both Time 1 and Time 2 were summed over all 48 practice problems for the between-subjects factor, group, and over 24 problems for the within-subjects factor, language.

Procedures

The overall experiment procedure was as follows. The was a short introduction followed by an explanation of the presentation format with an example. This was followed by presentation of the first rule. Practice problems concerning the application of the rule were presented in succession. This was repeated until the four rules were all presented. The cycle was repeated once for the first language and then replicated with the second language. For each of the four rules there was a short explanation of its purpose and syntax.

Practice Problems

The four rules, Delete, Find, Jump, and Replace, were presented in that order. Each rule was presented and a problem was given. There were three problems for each rule. Students input an answer to the problem using the virtual keyboard on the right side of the screen. If the answer was correct they received feedback and proceeded to the next problem. If the answer was incorrect they were recycled through the explanation and the problem was repeated. If the student was unable to get the correct answer after three tries, the correct answer was displayed. Students then went on to the next problem.

After the third problem, subjects went on to the next rule. Upon completion of the block of four rules, subjects returned to the first rule and the process was repeated with different problems. Thus there were 24 problems per language (3 problems X 4 rules X 2 blocks).

Upon completion of the 24 problems, a 12 question posttest was administered by computer. Problems were similar, but not identical, to the previous practice problems. In contrast to the practice problems, no textual or graphic information was available and no feedback was given. The 12 posttest questions for each language were identical, but the answers, needless to say, were not. After the first posttest, subjects were informed that they would learn a second similar language, but were warned not to assume the languages were the same.

Results

The data used in the statistical analysis were obtained from the practice problems and the posttest. A KR-20 reliability score of .85 was calculated on the practice problems. Item data were not retained for the posttest but a correlation of -0.65 was obtained between the mistakes data and the posttest. Equivalent reliability is assumed for the posttest due to the parallel nature of the practice items and the posttest items. The dependent measures were mistakes, failures, posttest scores, and elapsed times (Time 1, Time 2, and total time).

Mistakes and Failures

Because the dependent variables, mistakes and failures, were measured over the same independent variables a MANOVA was calculated. The independent variables were Group, Language, Block, and Order. Significant effects were found for Group, $F_{(2,288)} = 29.56$, $p<.0001$, Language, $F_{(2,287)} = 5.192$, $p<.0061$ and Block, $F_{(2,287)} = 9.23$ $p<.0001$. Order was not significant but interactions due to Order-by-Group, $F_{(2,288)} = 5.14$ $p<.0064$ and Order-by-Language-by-Block, $F_{(2,287)} = 4.90$ $p<.0081$ were found. Since the effects due to the order of the two languages were an artifact of the research design they have little theoretical interest. The effects due to practice block indicate that practice resulted in an improvement in performance. The important factors, Group and Language, were statistically significant indicating that differing results were obtained on the dependent variables depending on which language and which presentation format was being learned.

To investigate more closely the dependent variables, Mistakes and Failures, the variables were entered separately into repeated measures analyses using the SAS computer program. The SAS program treats the within-subjects factors as dependent measures and computes a MANOVA for these factors and their interactions. Between-subjects factors are computed with an ANOVA. A summary of Mistakes and Failures data can be found in Tables 2 and 3. Results were similar for both dependent measures and essentially duplicated the results reported above with a few exceptions. The most important finding was that, for both dependent measures, significant differences were detected for both Group and Language. For Mistakes, the results were $F_{(2,72)}=8.52$, $p<.0005$ for the Group factor and $F_{(1,72)}=26.03$, $p<.0001$ for Language. For Failures, the results were $F_{(2,72)}=6.75$, $p<.0021$ for Group and $F_{(1,72)}=31.75$, $p<.0001$ for Language. Since the Group factor consisted of three levels, Newman-Keuls tests were performed for both dependent measures. For both measures the Text-Only Group performed at a lower level than the other two groups.

Table 2 Means and Standard Deviations of the Mistakes Data

	Language		
Representation	Consistent	Inconsistent	Totals
Metaphor			
M	4.12	5.354.71	
SD	4.39	5.62	5.05
Flowchart			
M	4.89	6.65	5.77
SD	4.89	6.70	6.07
Text Only			
M	9.50	11.77	10.64
SD	7.59	7.45	7.57
Totals			
M	6.18	6.23	
SD	6.23	7.41	

Note: Collapsed across Order and Block.

Table 3 Means and Standard Deviations of the Failures Data

Representation	Language: Consistent	Language: Inconsistent	Totals
Metaphor			
M	0.33	0.900.62	
SD	1.04	1.73	1.45
Flowchart			
M	0.81	1.37	1.09
SD	1.48	2.04	1.79
Text Only			
M	1.87	2.71	2.29
SD	2.43	2.45	2.46
Totals			
M	1.00	1.66	
SD	1.85	2.22	

Note: Collapsed across Order and Block.

Posttests

For the Posttests, a repeated measures analysis of variance was performed. The Language Factor was significant, $F_{(1,72)}=152.17$, $p<.0001$. The between-subjects factor, Group, was also significant, $F_{(2,72)}=38.44$, $p<.0007$. A summary of means and standard deviations may be found in Table 4. The Newman-Keuls follow-up test showed that the metaphor group was superior to the other two groups which did not differ.

Table 4 Means and Standard Deviations of the Posttest Data

Representation	Language: Consistent	Language: Inconsistent	Totals
Metaphor			
M	6.85	5.1211.96	
SD	1.52	1.56	2.78
Flowchart			
M	5.81	4.15	9.96
SD	1.79	1.67	3.28
Text Only			
M	5.00	3.54	8.54
SD	1.74	1.77	3.33
Totals			
M	5.89	4.27	
SD	1.83	1.77	

Note: Collapsed across Order.

Elapsed Time

Elapsed time data for the various conditions generally showed no significant differences. The one exception was the data for Time 2. The Group Factor produced a significant F-test, $F_{(2,75)}=18.17$ $p<.05$. A Newman-Keuls test of the Group factor showed that the Flowchart Group took significantly more time to complete their answers.

Discussion

Main effects were found for the between-subjects factor of Group and Language. The Text Only condition performed significantly worse on the practice problems, while the group exposed to the metaphorical notation performed significantly better on the posttest. The consistent language was significantly easier to learn as measured by mistakes, failures, and the posttest. Response times indicated that there was no difference in overall time to completion. The Flowchart group took significantly more time to complete their answers, although there was no difference between the groups with respect to onset of answer.

General Discussion

Visual metaphors proved superior to logical pictures and other presentational formats under several conditions. They caused command language syntax to be easier to interpret and remember compared to syntax presented with flowcharts, BNF, or pure text. However, no difference was observed between flowcharts and metaphorical graphics during practice in which subjects were required to generate command strings. This may be due to the fact that during the early stages of learning, subjects are not prepared to generate responses and that a more reasonable instructional strategy is to require discriminations. Since comparison of the elapsed time data did *not* show that subjects in the metaphorical condition required more time to respond, it can be assumed that the visual metaphor is understood more readily.

The most reasonable explanation for the superiority of the metaphorical notation is that subjects were familiar with the vehicle of the metaphor, namely, floorplans. Given that familiar domain, interpretation and internal representation of the meta-syntax was accomplished more readily than with alternative forms of representation. Since flowcharts do not resemble anything in the real world there is little possibility of transfer of real-world knowledge to the new task. Simple assimilation in the case of the visual metaphor, would account for the superior performance of the subjects exposed to the visual metaphor.

Knowlton hypothesized that metaphorical graphics would be beneficial when conveying intangible content. There are few empirical tests of this hypothesis. Bauer and Eddy's flowcharts were logical pictures by Knowlton's definition. On the other hand, Mayer's (1975) models resemble what Knowlton called analogical pictures. Mayer found that metaphorical models helped in the learning of a programming language. Davidson (1979) reported that the use of an analogical picture resulted in fewer errors in identifying assertions based on the text, ***Moby Dick***. Levin (1983) demonstrated the instructional effects of mnemonic pictures. Although some of Levin's examples are purely mnemonic, most involve analogical recoding using "transformational pictures." Aside from these isolated studies, there has been little direct investigation of metaphorical graphics.

The notation described in this paper is an example of the possibilities of visual metaphors. The metaphorical notation proved reliably easier to interpret, remember, and use than either a flowchart, BNF, or verbal text. Conclusions should be limited, however, by several of the the conditions of these experiments. First, subjects were generally computer-naive. Also, the superior results found for the metaphorical notation are due to the specific notational conventions listed herein. An earlier version of the notation, which contained ambiguities, was not successful. This study should be thought of as an instructional design experiment rather than a psychological experiment. At most it can be thought of as an example of the method of single cases (Clark, 1973). Many more studies of the instructional effects of visual metaphor need to be done before general conclusions can be drawn.

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Analysis Towards Expression: A Structured Approach to Teaching Three Dimensional Design

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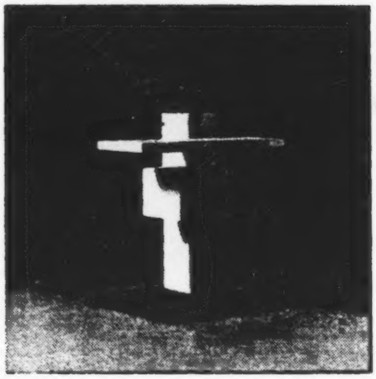
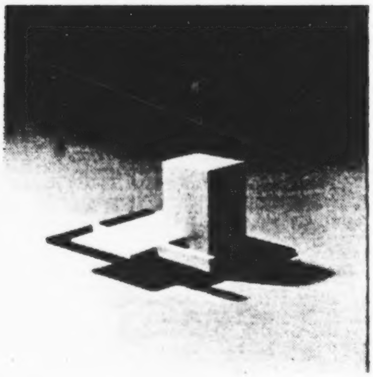
For the past eight years I have been using an analytical approach to teach visual literacy. I have been associated with several different programs and I have taught a variety of students, some students displayed visual talent and some with little or no seeming ability in visual expression. In most cases I have been able to make students aware of the value and application of visual literacy. The core of what I teach is based on the principles of abstract three-dimensional expression developed at Pratt Institute and the School of Architecture and Design at the Illinois Institute of Technology. In addition, I have developed several projects that are compatible with the themes of the Modern Movement and reflect the changes needed to address new issues in art and design education. The approach is based on the assumption that an individual of average intelligence can learn to observe and express himself visually, and this ability is different than verbally oriented observation and expression. When individuals learn this approach they have an entirely new way to perceive the world. Furthermore, this ability can be used in a variety of ways and is a necessary complement to verbal expression.

This approach emphasizes a reversal of the usual visual/verbal relationship in structured education. These courses emphasize visual analysis and expression and uses verbal analysis as a supplement. This is accomplished by using a studio or lab structure. Students work on projects in class and receive direct feedback in group and individual critiques. This approach evolved during the first half of this century.

During the period known as the Modern Movement (approximately 1919 - 1975), educators in art, design and architecture developed new approaches for educating students. The Bauhaus in Germany was the first program that attempted to synthesize the new ideas in art, crafts, science and technology into an educational curriculum. While the educators at the Bauhaus had many obstacles to overcome, they did establish a new direction in visual education that became the dominant point of view for many years. The Nazi government disapproved of the Bauhaus and it was forced to close in 1932. Many of the educators eventually came to the United States and by 1940 had started programs of their own. Most notable of these was Walter Gropius, Ludwig Mies Van Der Rohe, Lazlo Moholy Nagy and Joseph Albers. In addition to these individuals, several other educators in the United States developed programs as well. In 1939 Rowena Reed Kostellow and her husband Alexander Kostellow established a foundation program and a department of industrial design at Pratt Institute in Brooklyn, New York.

All the programs started by these individuals shared a common theme: they developed new ways in teaching visual literacy. The programs began with a foundation year that made students aware of basic principles of visual organization and expression. The courses offered were drawing, two-dimensional design, three-dimensional design and color. For the purposes of this paper I will focus on the three dimensional design classes developed by the Kostellows at Pratt Institute, Lazlo Moholy Nagy and Jay Doblin at the Institute of Design, Illinois Istitute of Technology and Mies Van Der Rohe at the College of Architecture, Illinois Institute of Technology.
On the following pages are examples of projects I have given to students in classes of three-dimensional design. Each project has a brief introduction similar to the one that the students receive. The emphasis is not on teaching through lecture and example; instead, only brief introductions are given. The learning occurs through the interaction during the project. This educational process is direct and self-evident through the focus on the project itself. This is a phenomenalogical approach to education. It is also a qualitative approach that relies on the teacher to develop clear simple guidelines that can be communicated directly to students with a minimum of ambiguity. This approach balances three variables: the ablity to conceive ideas (concept), the ability to develop and express ideas (process) and the abiltity to develop a sense of order in expressing the idea (form). Each exercise deals with all three variables, however the emphasis changes.





PROJECT TITLE: THREE-RECTILINEAR SOLIDS

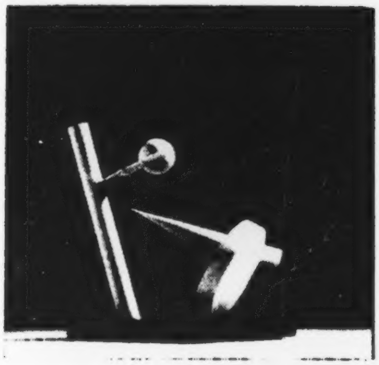
PROJECT STATEMENT: Select three rectilinear solids: one planar, one linear and the third volumetric (mass). Using the x,y,z (static) axes, organize these solids in right angle relationship to each other. Each solid is joined to another by means of simple joint such as a dado or rabbet. Possible spatial arrangements are studied by creating three-dimensional sketches from clay or another flexible material. Final designs are executed in wood, painted flat white, and mounted on a black base.

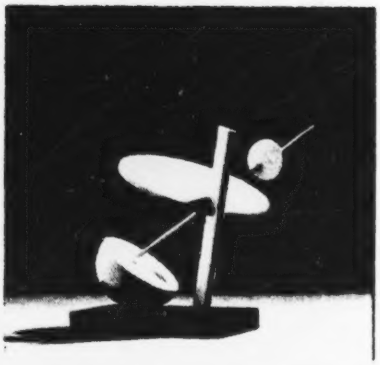
SKILLS: Introduction of clay as material for sketching. Students learn to combine forms three-dimensionally using basic joints. Demonstrations are given on the table saw, band saw, sanders and spray paint booth.

CONCEPTS: Several basic visual themes are emphasized in this project: types of proportion (inherent, comparative and overall); static axis of organization; dominant (primary), subdominant (secondary) and subordinate (tertiary) relationships: rectilinear volume as a basic design element. In addition, students learn the design process by starting with a variety of ideas and through development and refinement, one idea emerges into a well defined and developed visual statement. This project is the cornerstone of the series and introduces the themes that will be developed and reiterated throughout the year.

TIME ALLOTTED: Five weeks

STUDENT LEVEL: First project, first semester





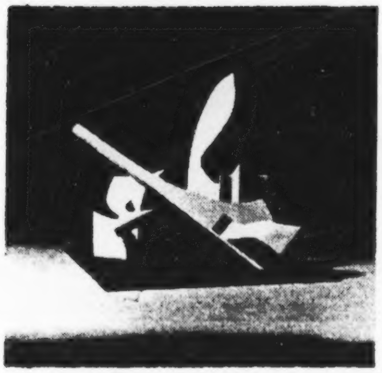
PROJECT TITLE: CURVILINEAR GEOMETRIC SOLIDS

PROJECT STATEMENT: Choose three different curvilinear solids and construct a balanced three-dimensional design using a dynamic axis of organization. All forms must be joined three-dimensionally: no butt joints are permitted. Begin sketching using foam, foamcore board, cardboard and paper. Create a variety of curvilinear forms in different sizes and proportions. Each sketch must contain three elements: one planar, one linear, one volumetric (mass). In addition, there must be a clear dominant, subdominant and subordinate relationship in each sketch. The best sketch is then made into a well crafted final using appropriate materials.

SKILLS: Students learn to work with the following sketch materials and tools; foam, foam core board, paper, matt knife, hot foam cutter, and glue gun. For the final model students must learn to work with the following tools and materials: lathe, band saw, sander, spray paint, acrylic sheet, wood, auto body putty.

CONCEPTS: Conceptually students learn to control and work with curvilinear solids as a group of shapes. They are made aware of the dynamic axis of organization. More complex joints are used to combine shapes. Finally the process of developing a design from a rough sketch to a well balanced and well crafted final is reinforced. This is the complement of rectilinear solids assignment and should follow right after it. An added level of difficulty can be given to this project by increasing the number of elements from 3 to 5 or 7. Two distinct movements should be used if the number of elements used is increased and a stronger emphasis can be given to the concept of negative space.

TIME ALLOTTED: Four to six weeks
STUDENT LEVEL: Second project, first semester



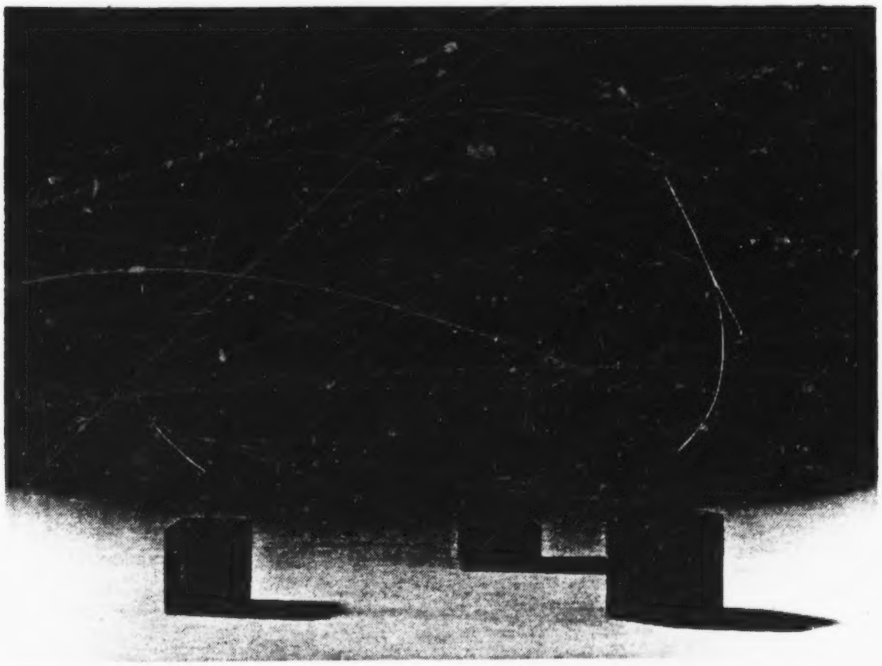
PROJECT TITLE: FRAGMENTATION

PROJECT STATEMENT: Select a basic rectilinear or curvilinear form with a good inherent proportion. Fragment the form into three very different pieces that have a dominant, subdominant and subordinate relationship to each orher. Using all three pieces, create a balanced design in three dimensions. The basic shape must be made in clay, then fragmented. When three interesting fragments are developed, the forms are then cut out of foam, cardboard or foam core board. The fragments are then used as design elements in a three-dimensional composition. Fragments can be arranged along static or dynamic axes. When the sketch has been resolved the design is fabricated in a permanent material.

SKILLS: Using the materials and tools from the previous projects, students are able to further refine their skills. The designs are more complex and demand greater model making skills in order to construct a well crafted final model.

CONCEPTS: Students learn that form development can be both a subtractive method (fragmentation) and an additive method (combining fragments into a design). Many products are fragments or combinations of fragments. This project reinforces the principles introduced in the previous two assignments, while allowing for greater personal interpretation of form and arrangement of form. An added level of difficulty can be given this project by increasing the number of basic shapes from 1 to 2 or 3. This will create 6 fragments (two basic shapes) or 9 fragments (three basic shapes). The time allowed for the project should be increased and it is often too difficult for first semester students.

TIME ALLOTTED: Six weeks (3 fragments), Eight weeks (6-9 fragments).
STUDENT LEVEL: Third project, first semester (3 fragments).
First project, second semester (6-9 fragments).



PROJECT TITLE: LINES IN SPACE (ABSTRACT)

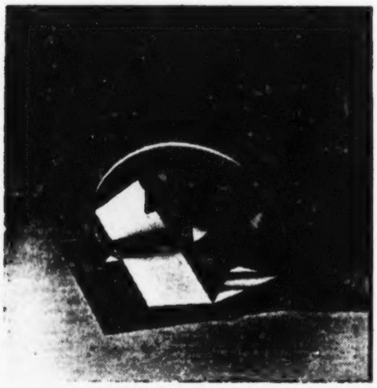
PROJECT STATEMENT: Select five different types of basic lines and connect them end to end to create a balanced and dynamic visual shape. Construct as many sketches as possible (10 - 20) in 24 gauge copper wire. Keep sketching until you have a unique and successful design. Construct a final of that design in 18 gauge wire and mount it on a base.

SKILLS: Students learn to solder and braze. Use of a soldering iron (soldering) and acetylene torches (soldering and brazing) are introduced. In addition, students are given a shop assignment to solder and braze metal rod and sheet material and must learn to use a break and a sheer for this assignment.

CONCEPTS: Students learn to see line three-dimensionally as a descriptive element. Line can be used as an axis through form; as an outline around form; or as a line that three dimensionally expresses form.

TIME ALLOTTED: Four weeks.

STUDENT LEVEL: Fourth project, first semester.



PROJECT TITLE: PLANES IN SPACE

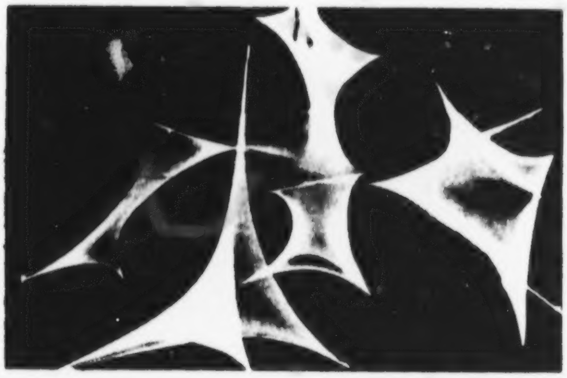
PROJECT STATEMENT: Select three to five planes that vary in proportion and type. Place these planes in a three-dimensional abstract relationship to each other. The placement of the planes must create visual tension among the surfaces and also the major and minor axes of the planes. In addition, the planes must create dynamic negative spaces. Five initial sketches are made; the best sketch is selected and developed into a well crafted final.

SKILLS: Sketching materials used for this project are paper and foam core board. The final is constructed in white styrene and acrylic sheet. Students learn how to cut and form styrene and how to use an acrylic solvent applicator.

CONCEPTS: This project teaches students how to visually analyze surfaces. They become aware that every surface has a major and minor axis. Planes are two-dimensional and when placed in opposition create negative volumes that are easy to see. This fact makes it easier to stress the awareness and control of negative volume in this project.

TIME ALLOTTED: Four weeks.

STUDENT LEVEL: Fifth project, first semester.



PROJECT TITLE: TENSILE STRUCTURE

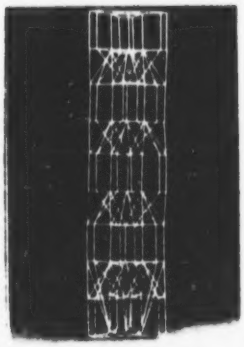
PROJECT STATEMENT: Working in teams of two, develop a design using fabric in conjunction with compression and tension members. There are two options to the project: design a structure on a base or a free floating structure in a cage.

SKILLS: Students must fabricate a frame structure brazing 1/4" wire rod, working with stretch fabric and nylon fishing line.

CONCEPT: Students must learn to work effectively as a team. Aspects of teamwork like cooperation, division of labor and sharing responsibility are discussed. The advantages of working with a partner as opposed to individual effort are reviewed, as well as the idea that design is often a cooperative effort. The relationship is made between tensile structures and other tension and compression systems (polyhedra and tensegrity).

TIME ALLOTTED: Four weeks.

STUDENT LEVEL: Second semester, second or third project.



PROJECT TITLE : POLYHEDRA TOWER

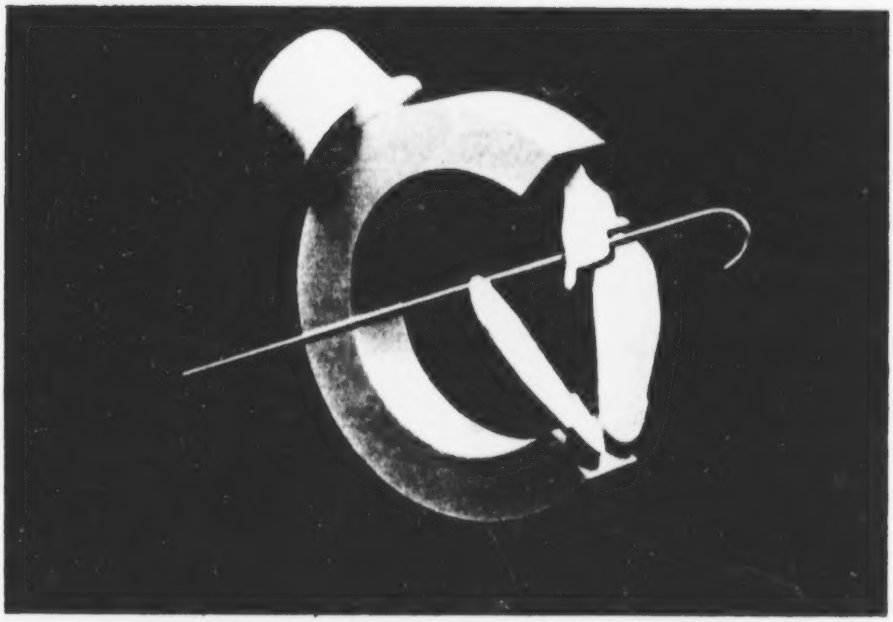
PROJECT STATEMENT: Design a cell configuration (approximately 6"-8" in height) using regular and/or irregular polygons; then stack the multiples of the cell into a tower. The tower must be aesthetically pleasing and also support a weight of ten pounds. The structure must be constructed of 1/8' dowels and can be no lower than 30" or higher than 36".

SKILLS: Students learn to construct the basic polyhedral shapes (Platonic and Archimedian solids). These shapes are constructed in two ways: open forms made from straws and pipe cleaners and closed forms made out of paper. The basic cell configuration is designed by sketching with straws and pipe cleaners. .In order to construct the tower a production system for precisely cutting the dowels and building the cells must be developed. Precision is critical for satisfying the structural and aesthetic requirements of this project.

CONCEPTS: This project emphasizes the diversity and structural nature of polyhedral systems. The factors that effect these structures such as tension, compression and torsion are also introduced. The relationships among polyhedra, tensegrity and tensile structures are illustrated.

TIME ALLOTTED: Four weeks.

STUDENT LEVEL: Second semester, first or second project.



PROJECT TITLE: THREE-DIMENSIONAL SYMBOL

PROJECT STATEMENT: Choose a theme and develop a symbol that expresses it. The theme can be a person, place, historical event or an emotion like love or hate. After an appropriate theme has been chosen, define it and identify key words and objects that are fundamental to the theme. Using the key words and object analysis as a basis, make three-dimensional forms that express the theme. The forms should be kept abstract while sketching. Using these forms, develop sketches using the appropriate abstract principles of organization. Realistic detail can be added if necessary once the formal issues have been resolved. A sketchbook showing development of the design must be submitted with the final project.

SKILLS: This project draws on the skills learned in the first semester. Students must choose their own sketching materials and the final model must be fabricated in the material that best suits the design.

CONCEPTS: For this project students must come up with an idea which they will then translate into a three-dimensional symbol. The student must interpret his idea successfully for others to recognize the symbol. Finally students document the project in writing and use two-dimensional sketches as a supplement to sketching three-dimensionally.

TIME ALLOTTED: Six weeks

STUDENT LEVEL: Second semester, third project.

Educational and psychological research in the last two decades has begun to develop an understanding of the complexities of the visual processes. While this research has yielded a better theoretical understanding, it has not for the most part been translated into pragmatic educational approaches. The area where research has had an impact is in early child development. However, there has been little progress made at applying the results of this research to higher levels of education. The "visual disciplines" of art, design and architecture have been teaching visual principles for most of the twentieth century. What the visual disciplines have lacked is a clear theoretical base and quantitative substantiation for their pragmatic educational programs.

The goal of the "visual disciplines" has been to educate students to express themselves visually with a level of articulation that is equal to verbal expression. In the beginning of this century, artists, designers and educators of the Modern Movement began a revolution in visual education that completely changed the approach of how students in visual fields should be taught. The emphasis of this new direction was on the training of the senses, primarily visual, to develop an understanding of the basic formal principles that underlay all methods of formal expression; whether static or dynamic, three-dimensional or two-dimensional. Movements like the Bauhaus in Germany, the Suprematists in Russia, and the DeStijl Movement in Holland all dealt with formal issues. These various movements stressed the importance of a reductionist approach toward formal expression and emphasized abstract representation. This was inspired by the scientific theories of the time and the philosophy that emphasized an egalitarian approach to art in society. Furthermore, it was a philosophical rejection of the formal expression that had gone before it.

While art, design and architecture are no longer dominated by the principles of the Modern Movement, the value of these principles evolved during the 1920's and 30's are still critically important to the education of students in "visual disciplines." In addition, the growing complexity of technology necessitates the use of visual tools of expression for all disciplines. This makes it essential for any student to become aware of the basic principles of formal organization. In addition, there is a necessity to integrate pure abstract formal analysis with issues of content and verbal expression. Although it is possible in education to separate visual and verbal literacy, the challenge of the future generation of educators will be the synthesis of these two areas. Before this can occur, educators must be made aware of the importance of visual literacy in all levels of education.

When many people are asked if they have any artistic talent they respond by saying they can't draw a straight line. However they usually are capable of doing something much more difficult. Tney can write using a symbol system that represents 26 different sounds and can compose units called words that can be linked in sequence to form sentences that are governed by rules of syntax. Both words and sentences can express ideas (thoughts related to actions) and describe a sequence of events or simply identify or differentiate objects. If this complex system to communicate to others, the world in which live, can be taught why should it be so hard to see it and express it in visual terms as well.

From birth until roughly the age of five children are given the oppurtunity to develop an awarenes of form, color and visual expression. Cognitive psychologists have studied and identified levels of development in children. Parents and preschool educators are aware of these levels and much of the early formal education of children is based on these principles of sensory motor development. Language and literacy are dealt with in less direct ways. However, once formal education begins the focus shifts and children are emersesed in a structured educational approach that emphasizes verbal literacy. In addition structured visual education is no longer emphasized or is deleted altogether. Students that exhibit visual ability are given little oppurtunity to develop their skills and little recognition for expressing their talent.

The main issue for contemporary education in light of technological advances in visual communication is how better to incorporate visual literacy into mainstream education. Writing, reading and speaking are no longer the only way to express oneselve. Nor is it the only way to think.

Pre-electronic Illusionary Devices: 19th Century Tricks on the Eye

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Like today's hi-tech visual devices - slide projectors, computers - pre-electronic optical toys and illusionary devices combined science, art and showmanship to amaze, amuse and educate their viewers. Some of these early devices are still in use today. All of them have direct visual and operational relatioinships to contemporary visual communications devices. Following is a list of some of the toys and devices that were once the primary ways to play "tricks on the eye".

Peep Show
Polyrama Panoptique
Magic Lantern
Thaumatrope
Phenakistoscope
Zoetrope
Stereoscope
Praxinoscope
Cinematographe

These are some of the major optical toys and devices of the 19th century. To know them is to appreciate them. We should honor their place in our visual world. Because they come to us through a complex meshing of play/magic/toys/science/photography/physics/art/philosophy, it is challenging to find bibliographic references. The Magic Lantern Society of Great Britain published a **MAGIC LANTERN BIBLIOGRAPHY** by Dr. Hauke Lange-Fuchs in 1987, Research Project No. 1. This bibliography is for the scholar. On the next two pages are some popular references.

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Effectiveness and Efficiency of Elaboration Using Computer-Assisted Instruction

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The popularity of the personal computer in the schools and in training facilities has made the possibility of personal education a reality. The most recent development of interactive video has made the computer even more versatile by pairing it with visuals provided by video cassette recorders or by slide systems. The combination of visuals and computer-generated lessons has made an already confusing situation even more so; educators must now make many more decisions about the best way to present their materials to learners. One of these teacher decisions deals with the amount of and with the kind of elaboration needed to provide a desired degree of student achievement while maintaining a realistic time frame for the instructional process. This study deals with the question of elaboration and with the efficiency of instruction in an attempt to find the best way to present material to learners.

The major weakness in the human information processing system is the short-term memory. In order to transfer information from short-term memory to long-term memory it must be coded. Coding is a transformation process in which new information is integrated in various ways with known information.

Recognizing the limitations of short-term memory and the need for providing good retrieval cues is a prerequisite for good instruction. Any strategy or manipulation taking place during instruction can alter the cognitive structure and strengthen the pathway to the information to be learned and remembered.

Many activities have been developed to help the learner integrate new information with existing knowledge, such as advance organizers, questioning strategies, feedback, and review procedures. Each of these activities provides for some degree of elaboration, defined by Ellen Gagne as "the process of adding to the information being learned" (Gagne, 1985, p. 83). Elaboration facilitates retrieval in two ways. First, it provides alternate retrieval pathways along which activation can spread (Anderson, 1976). Second, it provides extra information from which answers can be constructed (Reder, 1982). Although much research has been done with the above activities, questions still remain: (a) How much elaboration is needed to obtain the desired information? (b) which mathemagenic activities provide the best means of gaining information? and (c) How much time should be spent on these activities to optimize information acquisition? This study added, in a step-like fashion, an increasing degree of elaboration to an instructional unit to determine what effect it would have on a posttest performance which would measure different levels of educational objectives. The activities which provided the elaboration were embedded questions, computer-generated feedback and overt rehearsal strategies.

The primary purpose of this investigation was to assess the effect of varying degrees of elaboration in a self-paced computer-assisted instructional situation and was designed to test the following null hypotheses:

H1: There will be no differences in student achievement scores among the four elaboration formats (control, embedded questions (TR1), computer generated feedback (TR2), and computer generated feedback with a visual rehearsal strategy (TR3)) on tests measuring different educational objectives.

H2: There will be no interaction between prior knowledge levels and elaboration strategies among students in the four treatment groups.

H3: There will be no differences in lesson completion time between types of elaboration strategies among students on tests measuring different educational objectives.

H4: There will be no difference in efficiency scores on tests measuring different educational objectives by treatment group.

In this study, the subjects were 148 undergraduate students (69 males, 79 females) enrolled at the Altoona Campus of Penn State University. These subjects were all volunteers enrolled during the Fall semester of 1987 or the Spring semester of 1988. Subjects completed an initial pretest consisting of a paper and pencil test with [illegible] items on general content in human physiology developed by Dwyer (1972). The physiology pretest mean was used to divide students into high and low prior knowledge levels. The [illegible] subjects were randomly assigned to four treatment groups. An ANOVA run on the physiology pretest results found no significant difference in achievement among the treatment groups.

The instructional content developed by Dwyer (1972) consisted of a 1200 word instructional unit describing the parts of the human heart, the internal functions of those parts, and the interrelated simultaneous functioning of those parts with 33 visuals of the heart on 2x2 slides. The visuals employed consisted of simple, colored line drawings depicting the form and relative locations of the parts of the heart as they are mentioned in the instruction. The illustrations featured printed words and arrows focusing student attention on the critical parts being described.

The instructional treatments were presented via an interactive video slide system comprised of the following equipment: an Apple IIe microcomputer, a color monitor, and a Telex Caramate 4000 slide projection system.

Two of the four posttests developed by Dwyer (1972) and revised by Lamberski (1980) were utilized in this study. A description of the two tests as adapted from Dwyer (1978, pp. 45-47) follows.

Drawing Test.

The objective of the drawing test was to evaluate student ability to construct and/or reproduce items in their appropriate context. The drawing test (N = 20 items) provided the students with a numbered list of terms corresponding to the parts of the heart discussed in the instructional presentation. The students were required to draw a representative diagram of the heart and place the numbers of the listed parts in their respective positions. For this test the emphasis was on the correct positioning of the verbal symbols with respect to one another and in respect to their concrete referents.

The original drawing test was revised slightly in this study to test for the effects of cued and uncued responses. Instead of giving the learner the 20 terms to identify on the heart drawing, only 10 were given and the learner was asked to provide the missing 10 terms from memory, then

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locate them on the heart drawing. The part of the test having the 10 terms given to the learner was referred to as the cued recall drawing test P1 and the part of the test having no given terms was referred to as the free recall drawing test P2.

Comprehension Test.

The comprehension test consisted of 20 multiple-choice items. Given the location of certain parts of the heart at a particular moment of its functioning, the student was asked to determine the position of other specified parts of the heart at the same time. This test required the students to have a thorough understanding of the heart, its parts, its internal functioning, and the simultaneous processes occurring during the systolic and diastolic phases. The comprehension test was designed to measure the ability of the individual to use the information being received to explain some other phenomenon.

Each of the four instructional treatments in this study contained the same instructional script, visuals, terminology labels, and arrows. The treatments differed in the degree of elaboration employed.

For each treatment, except the control group, elaboration was added to the script in increasing degrees. A pilot test of the heart material provided 12 areas within the script where students were experiencing difficulty in comprehending the information being presented. Focusing on these 12 areas, questions possessing increasing degrees of elaboration were embedded in the appropriate sections of the script.

The first treatment, TR1, embedded questions at the end of each identified section which required the learner to respond by typing his response on the computer. All responses were accepted by the computer, and no feedback was given as to the correctness of the response.

The second treatment, TR2, added the same questions at the end of each identified section as did treatment one, but four response options were provided (A,B,C,D) with one of the choices being the correct answer and the other three acting as distractors. The learner pressed the letter of his choice and then the RETURN key. The response was evaluated by the computer and feedback was provided as to the correctness of the response to the learner. If the correct answer was given the learner was told it was correct and additional information on that particular topic was given to prior knowledge level subjects scored significantly better than the low prior knowledge level subjects.

In stage two when efficiency scores were introduced, a follow-up ANOVA found significant group [F(3,140) = 20.60, p < .0001] and prior knowledge level [F(1,140) = 3.90, p < .0502] effects. Tukey's HSD test using efficiency scores showed the Control group scored significantly better than all three of the other treatment groups. Treatment group TR3 scored significantly worse than the other groups and no difference was found between treatment groups TR1 and TR2.

A change from previous findings occurred when prior knowledge level effects on drawing test P2 were considered. In this case no difference in achievement was found among the two prior knowledge levels.

Findings

Time-on-Instruction

Finding that treatment TR3 had significantly more time-on-instruction was no surprise considering the extra time spent in doing the visual rehearsal strategy in treatment TR3. Treatments TR1 and TR2, although not taking nearly the time of TR3, still spent significantly more time-on-instruction than the Control group. A significant difference in time spent on instruction was expected with the increasing degree of elaboration taking more time to complete. In all cases this additional time spent on instruction resulted in higher achievement scores on all the criterion tests. The decision to adopt a treatment taking more time to complete would depend on the degree of mastery required and the time available for instruction.

The Comprehension Test

Although the first stage analysis found a significant difference in achievement among the four treatment groups there was no significant difference in achievement on the comprehension test. The increasing degrees of elaboration and the different types of elaboration did not increase the achievement on the comprehension test significantly.

The introduction of prior knowledge levels in the analysis did find, however, that high prior knowledge subjects scored significantly higher than low prior knowledge subjects on the comprehension test. It was felt differences were found in achievement on the comprehension test for any of the treatment groups however.

After introducing efficiency scores in stage two of the analysis a significant difference was again found between scores of the high and low prior knowledge level subjects [$F(1,140) = 9.96$, $p < .0020$]. Tukey's HSD test showed the high prior knowledge level subjects still scoring significantly better than the low prior knowledge level subjects when efficiency scores were used. A significant difference was also found among achievement scores of the treatment groups [$F(3,140) = 18.43$, $p < .0001$]. Tukey's HSD follow-up test showed treatment group TR3 scoring significantly lower than all the other treatment groups on the comprehension test when efficiency scores were used. The Control group scored significantly better than treatment groups TR2 and TR3, but no differences were found between the Control group and treatment group TR1. Additionally no differences were found between treatment groups TR1 and TR2.

The results of the ANOVAs run in the first stage of analysis found a significant difference in achievement on drawing test P1 among the treatment groups [$F(3,140) = 5.92$, $p < .0008$] and a significant prior knowledge level effect [$F(1,140) = 7.76$, $p < .0061$] when separate ANOVAs were run. Tukey's HSD follow-up test showed again a significant difference in achievement on drawing test P1 with treatment group TR3 scoring significantly better than the other three treatment groups. Tukey's HSD follow-up test also showed a significant difference between prior knowledge levels with the high prior knowledge level subjects scoring better than the low prior knowledge level subjects.

With the introduction of efficiency scores in stage two a significant difference was found from the follow-up ANOVAs and Tukey's HSD test among achievement on drawing test P1 for the treatment groups [$F(3,140) = 3.88$, $p < .0105$]. In this case, however, the Control group scored significantly better than treatment group TR3. A significant difference in prior knowledge levels was also found [$F(1,140) = 5.71$, $p < .0182$] with the high prior knowledge level subjects scoring better than the low prior knowledge level subjects.

In the first stage of the analysis a significant difference in achievement on drawing test P2 was found among the treatment groups [$F(3,140) = 3.46$, $p < .0182$] as was a significant prior knowledge level effect [$F(1,140) = 9.28$, $p < .0026$]. A significant difference in achievement on drawing test P2 was found with treatment group TR3 scoring significantly better than the Control group. Also the high were run. If no significant difference was found in the first stage the analysis was terminated.

In the second stage, the concept of efficiency was introduced with each subject's scores on the criterion tests being divided by his total time-on-instruction to provide an efficiency score for each test. A MANOVA was then run to check for overall group and prior knowledge effects and to look for possible group by prior knowledge interactions using these efficiency scores. Significant results were then analyzed further using follow-up ANOVAs and Tukey HSD tests.

The results of the preliminary MANOVAs indicated significant overall effects in each stage of the analysis. In the first stage a significant difference in achievement on the criterion tests among the treatment groups (F(12, 362.76) = 15.39, $p < .0001$) and a significant overall prior knowledge effect (F(4,137) = 3.03, $p < .0196$) were found. When efficiency scores were introduced in the second stage significant overall prior knowledge (F(3,138) = 3.47, $p < .0179$) and treatment (F(9,420) = 7.44, $p < .0001$) effects were found.

Based on these preliminary findings the previously described follow-up tests were run. Their findings are given for time-on instruction and each of the criterion tests.

In the first stage of the analysis a significant difference was found among the treatment groups for time-on-instruction [F(3,140) = 90.32, $p < .0001$]. Treatment group TR3 spent significantly more time than any of the other three treatment groups and treatment groups TR1 and TR2 spent significantly more time than did the Control group. Although the mean for the high prior knowledge level group was 36.8 minutes and the mean for the low prior knowledge level group was 33.9 minutes, no significant difference was found between the time spent on instruction for the two prior knowledge levels.

The findings of the first stage analysis of treatment group achievement on the comprehension test resulted in no significant difference among the treatment groups [F(3,144) =.43, $p > .05$] but a significant difference was found between achievement scores of the high and low prior knowledge level subjects [F(1,140) = 10.03, $p < .0019$]. Tukey's HSD test showed high prior knowledge level subjects scored significantly better than low prior knowledge level subjects on the comprehension test. No significant provide further elaboration. If an incorrect response was given the learner was told it was incorrect, why it was incorrect, and what the correct answer should have been. In giving the correct response the same basic elaboration was provided as was given to the learner who identified the correct answer.

The third treatment, TR3, had the same question structure as the second treatment, but with still further elaboration provided by an overt visual rehearsal strategy. This rehearsal strategy required the students to shade with colored pencils the specified parts and functions of the heart. The parts and functions to be shaded corresponded to, as closely as possible, the words that were used to answer the questions in treatments one and two. The shading took place on a separate sheet of paper with three provided drawings of the heart similar to those appearing on the lesson slides.

The experimental design of this study was a randomized posttest-only control group design (Campbell and Stanley, 1966). The variables manipulated in the study were the degree of elaboration present in the treatments. The dependent variables were the achievement scores on the Comprehension posttest, the two parts of the Drawing posttest, and time-on-instruction.

The computer program SAS (Statistical Analysis System) available from the Computation Center at Penn State University was used to do the statistical analysis on the data collected in this study. Using SAS-GLM (General Linear Model), since each cell had different numbers of subjects, a multivariate analysis of variance, MANOVA, was run to test for an overall effect. A series of univariate ANOVAs was then used for one-factor and two-factor analysis of variance as a follow up to a significant MANOVA. To test main effects when there was no interaction, the conservative Tukey Studentized Range (HSD) Test was used to compare pairs of means.The Kuder-Richardson 20 was used to generate the reliability coefficient for the multiple-choice tests.

The general analysis of the collected data was done in two separate stages with each stage examining a different aspect of the study. In the first stage a MANOVA was run to check for overall group and prior knowledge effects and to check for possible group by prior knowledge interactions on the criterion tests for the four treatment groups. If significance was found at the .05 alpha level, then follow-up tests using univariate ANOVAs and Tukey's HSD test of computer-generated feedback that was also included in TR3. Perhaps this elaboration while not very effective on its own (TR2) may interact with the overt visual rehearsal strategy to produce an effective means of presenting the material.

Drawing Test P2

The only difference between Drawing tests P1 and P2 was the cues present in P1 were absent in P2. The results were similar in that treatment TR3 was again significantly better than the other treatment groups when raw scores were used and considerably worse than the other groups when efficiency scores were used. The similarity ends when the treatments are compared for each test. The achievement on Drawing test P2 was the only one where each increase in elaboration resulted in a noticeable increase in achievement from the previous treatment. Achievement on the Comprehension test actually dropped in treatment TR2 while achievement in Drawing test P1 showed practically no increase from the Control to treatment TR2. Perhaps the elaboration done in treatments TR1 and TR2 while not improving achievement on Drawing test P1 with cued recall did provide the needed help in Drawing test P2 where recall cues were not provided. The rehearsal strategy of typing responses and answering questions present in TR1 and TR2 may have helped to further implant these terms into long-term memory. The achievement of the prior knowledge levels on Drawing test P2 were similar to those on Drawing test P1 with the high prior knowledge subjects having approximately the same difference in achievement over the low prior knowledge subjects in each treatment. The significance of Drawing test P2 seems to lie in the fact that it did not provide cues to help the subject recall the names for the parts of the heart so that they could then be located on the drawing of the heart. Because these cues were not given the subject had to remember them from the given instruction and at this point the additional elaboration given in the treatments may have provided some cues to help the subject retrieve this information from long-term memory.

Summary of Results

The hypotheses presented in this study and the results for each are as follows:

H1: There will be an insignificant difference among achievement scores of the four presentation formats, control, embedded questions (TR1), computer-generated feedback (TR2), and computer-generated feedback with a visual rehearsal strategy (TR3).

Drawing Test P1

The significant difference in achievement between the treatment groups on Drawing test P1 found in the first stage of the analysis showed treatment TR3 to be significantly better than the other treatments. Since treatment TR3 had a visual rehearsal strategy which was directly related to the information tested in Drawing test P1 it was not surprising that this treatment scored significantly better than the other treatments which did not have this additional visual component. Although the mean achievement scores in the first two treatments TR1 and TR2 were not significantly higher than the score of the Control group on Drawing test P1 they were higher (Control 5.11 to TR1 and TR2 5.49). This would seem to possibly indicate that the elaboration in treatments TR1 and TR2, while having some effect, did not effect achievement like treatment TR3 (mean score 7.55 out of 10). Previous research has shown (Dwyer, 1978; Dwyer and Parkhurst, 1982) that visuals such as the line drawings in this study used in conjunction with prose instruction co improve student learning and consequent ability to reproduce the visuals in a drawing test. However, in a study using similar material and treatments by Dwyer, 1984 no significant difference was found on the drawing test. The fact that Drawing test P1 was a test of cued recall evaluating the subject's ability to construct and/or reproduce items in their appropriate context was probably the main reason why treatments TR1 and TR2 did not show much effect since they did not concentrate on the visual aspects of the heart material. The increased elaboration in TR2 over TR1 was of little consequence as the content elaborated upon was not tested in P1.

As with the Comprehension test, the high prior knowledge subjects did significantly better than the low prior knowledge subjects on Drawing test P1. The difference in mean achievement scores for the high and low prior knowledge subjects were almost identical for each of the treatments showing that the elaboration had the same effect on both prior knowledge levels on Drawing test P1. Both prior knowledge levels increased their achievement as the amount of elaboration increased on the targeted material.

Using efficiency scores resulted in the Control group achieving significantly better than treatment TR3 on Drawing test P1, but no difference was found between the other treatments. This seemed to validate the earlier findings that treatments TR1 and TR2 had very little effect on achievement on Drawing test P1. The earlier mentioned study done by Dwyer, 1984 used the same content and similar tests but found no significant difference on the drawing test. The major difference between her study and this one was the use

Using efficiency scores resulted in the first significant difference between achievement of the treatment groups on the comprehension test. No difference was found when raw scores were used, but with the efficiency scores the treatment with the most elaboration TR3 scored significantly lower than all the other treatments. This result was not surprising considering the mean increase in achievement from the Control group to TR3 on the comprehension test was 0.98, but the amount of time spent on instruction more than doubled.

Although the difference in time-on-instruction between the Control group and treatment groups TR2 and TR3 was significant, their raw scores were not, which resulted in the Control group efficiency score being significantly higher than the efficiency scores of treatment groups TR2 and TR3. The fact that no significant difference in time-on-instruction was found between treatment groups TR1 and TR2 could help explain why no difference in achievement was found between these treatments when efficiency scores were used. The significance of these results was found in the realization that the considerable amount of time spent on instruction in treatment TR3 not only failed to increase achievement proportionately on the comprehension test but also resulted in a lower efficiency score. This finding would seem to suggest that improving achievement is not simply a matter of spending more time-on-instruction. Another notable point was that although the difference in time spent on instruction was significant between Control and treatment TR1, there was no significant difference between their efficiency scores which would imply achievement increased sufficiently in treatment TR1 to offset the additional time spent. A similar observation would apply for treatments TR1 and TR2. This would suggest that the increase in achievement on the comprehension test gained by increasing the degrees of elaboration in the first three treatments was a worthwhile use of time spent on instruction. Treatment TR3 did not satisfy this condition because its considerable increase in time-on-instruction was not offset by a comparable increase in achievement on the comprehension test.

One final point on the comprehension test results would be to consider the fact that only 6 question areas received elaboration out of the 20 questions on the test. It would seem logical to assume that any increase in achievement on these 6 questions would not have the same effect as increases in the 6 questions elaborated upon in the drawing tests which have only 10 questions each.

that increasing the amount of elaboration would help decrease the significant difference between achievement scores of the two prior knowledge levels, but this did not occur. A possible explanation for this failure to overcome these existing differences might be the difficulty of the test material. The mean score on the comprehension test was 11.392 out of a possible 20 with the high prior knowledge subjects having a mean score of 12.432 and the low prior knowledge subjects having a mean score of 10.351. With so much room for improvement it was unlikely the high prior knowledge subjects experienced a ceiling effect which would have allowed the lower prior knowledge subjects to close the gap between their scores.

Although the difference in treatment group scores for the high and low prior knowledge subjects were not statistically significant, they did suggest that the increasing degrees of elaboration helped the low prior knowledge subjects more than the high prior knowledge subjects on the comprehension test.

A further consideration might be that the six questions that were elaborated upon in the comprehension test were concerned with functions of certain parts of the heart at specific times, but the increased elaboration in treatment TR3 was visually oriented and more likely to effect achievement on the drawing tests than on the comprehension test.

The consideration of efficiency scores in the second stage of the analysis also showed the achievement of the high prior knowledge subjects to be significantly better than the low prior knowledge subjects on the comprehension test. This result pointed out that any difference in time spent on instruction between the two prior knowledge levels was not a significant factor in their achievement scores. The high prior knowledge subjects did spend more time (approximately three minutes) on instruction than did the low prior knowledge subjects. Since efficiency scores were determined by dividing each test score by total time-on-instruction for each subject, a significant difference in time-on-instruction between two subjects having comparable raw scores would result in the subject who spent more time-on-instruction having a lower efficiency score. Since the high prior knowledge subjects still scored significantly better than the low prior knowledge subjects when efficiency scores were used, this would seem to imply that achievement increased with time-on-instruction so that the overall ratio of achievement score to time-on-instruction remained about the same for both prior knowledge groups.

This hypothesis was rejected as a significant difference was found between the achievement of the four presentation formats with treatment TR3 having the highest achievement scores on all three criterion tests.

H2: There will be an insignificant interaction between prior knowledge level and type of rehearsal strategy among students in the four treatment groups.

This hypothesis was retained as the subjects with high prior knowledge level achieved significantly higher scores on all the criterion tests than the low prior knowledge subjects regardless of the treatment.

H3: There will be insignificant differences in lesson completion time between types of rehearsal strategies among students on tests measuring different educational objectives.

This hypothesis was rejected as a significant difference was found between the time-on-instruction for each of the treatments with TR3 > TR2 > TR1 > Control. As the degree of elaboration increased the subjects spent more time-on-instruction even though the instruction was self-paced.

H4: There will be an insignificant difference in efficiency scores on tests measuring different educational objectives by treatment group.

This hypothesis was also rejected. As the degree of elaboration increased the time-on-instruction also increased yielding a significant increase in achievement on the three criterion tests. Although the test scores did increase significantly, the efficiency scores of each treatment group diminished as the amount of time spent on instruction increased for each of the criterion tests. Control > TR1 > TR2 > TR3.

Conclusions

The results of this study have provided some interesting points for consideration before planning any instruction using increasing degrees of elaboration. As with most research these findings can only suggest a possible path to follow when preparing instruction, but a path nonetheless.

The fact that elaboration works seems to be rather clearly shown. The effect of elaboration on high prior knowledge subjects can be both helpful and harmful depending on the circumstances of the instruction. If the content is rather easy the time taken for elaboration is probably not time well spent for the high prior knowledge subject and could lead to boredom and a subsequent decrease in achievement. The effect of elaboration on the low prior knowledge subject for easier material is much more positive as it allows this type learner to acquire material that would be missed without the extra elaboration. The extra time spent on instruction because of the elaboration also helps the low prior knowledge learner to better organize the material in short-term memory which results in better retention and retrieval from long-term memory. With harder material the effect of elaboration is going to depend to a large degree on the amount of elaboration and time spent on the instruction with the lower prior knowledge learners requiring considerably more of both than the higher prior knowledge learners.

The efficiency of instruction using elaboration will generally be rather poor as more elaboration goes hand in hand with more time spent on instruction. The results of this study seemed to indicate that the gains in achievement were not commensurate with the amount of time spent on the instruction.

Subjects with high prior knowledge will consistently score better than subjects with low prior knowledge regardless of the kind or amount of elaboration. On tests of increasing cognitive difficulty both groups will benefit about the same from the extra elaboration.

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Development of Visual Communication Courses

Forrest Wisely, Dorothy Kennett & James Bradford
Illinois State University

Introduction

Illinois State University, the first institution of higher education in Illinois, was founded in 1857 as a normal school. Today Illinois State University is a multipurpose university with the primary mission to provide the highest quality undergraduate education in Illinois, supported by various graduate programs. In addition to the College of Education, there are now five other colleges in the university: Arts and Sciences; Applied Sciences and Technology; Fine Arts; Business; and Continuing Education and Public Service. The total enrollment in theses six colleges is more than 22,000 students in bachelor's, master's and doctoral programs.

The Department of Communication is one of fifteen departments of the College of Arts and Sciences. The department was originally formed in 1972 as the Department of Information Sciences by combining existing programs in speech communication, journalism, radio and television, instructional media, and library science, and plans to develop a program in computer science. A number of factors altered the original goals of the department. So in 1975 the name of the department was changed to the Department of Communication.

Today the Department of Communication has more than 1200 majors in undergraduate programs in speech communication, mass communication, and public relations as well as a comprehensive applied communication master's degree program.

Curriculum Development

Based on a perceived need for compentencies in the selection, development, use and understanding of visuals by communication majors, a curriculum development project was undertaken to review and revise courses which could contribute to the visual literacy of our students.

The goal of the project was to develop a series of courses to enable communication majors to develop and use visual messages to achieve specified outcomes with particular audiences. The development of technical skills is not a major element within the program, but visual communication-related production skills are taught to the level needed (1) to provide an understanding of the communication potential of each medium and format, and (2) to enable students to work creatively and productively with professional photographers, printers, videographers, graphic artists and other personnel.

The curriculum development project involved an analysis of the competencies defined for majors in the various communication programs, a review of the existing courses which contribute to the compentencies, an identification and implementation of needed changes in existing courses, and an assessment of the effectiveness of visual communication instruction once improvements are in place.

This paper briefly identifies the general competencies expected of graduates of each of the major programs in the department, and describes the visual communication components of specific courses which have been or are in the process of being revised to achieve visual communication competencies.

Communcation Majors

Speech Communication: The speech communication program at Illinois State University provides students knowledge and skills in message design, message strategy, and the use of analysis, interaction, feedback, adaptation, and language in the human communication process. Graduates of the speech communication program take positions in customer relations, sales, management and employee training and development, personnel, advertising, and teaching.

Mass Communication: The mass communication program includes studies in both print and broadcast media. The focus is on the theories and skills needed to communicate messages to mass audiences. Graduates of the mass communication program have been placed in positions in radio, television, and newspapers as editors, reporters, photojournalists, production managers, account executives, customer service representatives, and sales people on the national and state levels. They have also been placed in various business and government positions as media specialists.

Public Relations: "Public relations is a process that furthers mutual understanding and cooperation between an individual, a corporation, a government agency, or any public organization and its various publics or constituent groups. The public relations professional...maintains a program of activities and communication to obtain, goodwill, support, and understanding." (Public Relations Society of America) To accomplish this goal public relations majors must develop knowledge and skills in communication theory, communication problem analysis, selection of problem- solving strategies, message design, message delivery systems use and evaluation.

Master's in Communication: The master's degree in communication at Illinois State University emphasizes the applied nature of communication based on a solid foundation of research and theory. The program focuses on the study of symbolic interaction among humans to disseminate and acquire information, manage conflict, regulate behavior and social influences, solve problems, and form and maintain human relatlionships. Master's degree graduates take positions in mass communication, public relations, organizational communication, and teaching, or they continue their education at other universities to obtain a doctorate in communication.

Curriculum Analysis

An analysis of existing department course offerings revealed that most of the defined competencies were being achieved. However, the development of visual communication competencies was not found to be addressed directly or systematically.

Nine existing courses were identified (Figure 1) which contained objectives specifically contributing to the development of visual communication competencies. These course are currently in various stages of development to enhance their visual communication components and are described in detail below. A number of presentation packages, a textbook, and workbooks are planned for our own use and to share our experiences anddiscoveries with others in the communication who see the need to begin to educate students with visual communication competencies.

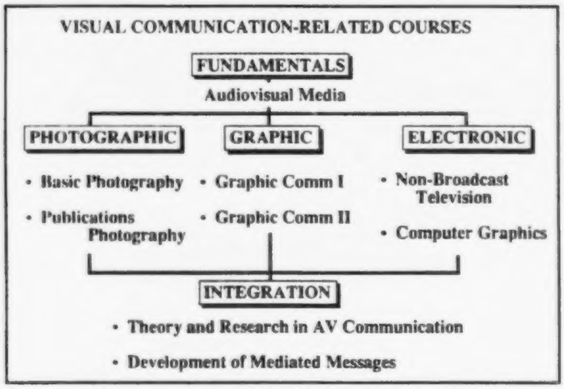
VISUAL COMMUNICATION-RELATED COURSES
FUNDAMENTALS
Audiovisual Media
PHOTOGRAPHIC
GRAPHIC
ELECTRONIC
• Basic Photography
• Publications Photography
• Graphic Comm I
• Graphic Comm II
• Non-Broadcast Television
• Computer Graphics
INTEGRATION
• Theory and Research in AV Communication
• Development of Mediated Messages

Figure 1. Visual communication-related courses under redevelopment.

Audiovisual Media

The basis of the visual communication program is a general course in audiovisual media . It is required of public relations majors and taken by many other students both in and outside the department as an elective. Beginning in spring semester 1989 the enrollment in this course will be 192 students.

It is our belief that virtually all professionals need to have skills which enable them to make presentations to small-to-moderate size groups. For this reason "Audiovisual Media," the course which introduces concepts and applications of visual literacy, focuses on the professional presentation. The course teaches entry level cognitive, psychomotor and affective behaviors which relate to identification, design, production, presentation and assessment of visual media. *The purpose of the course is to introduce a variety of audiovisual media as they relate to three types of messages—informative, instructional, and motivational—and as they relate to individual, small or moderate size audiences.*

We have identified five broad goals for students in Audiovisual Media:

1. *Solve defined communication problems* as they relate to the identified types of messages and audiences.
2. *Design messages* using selected media.
3. *Select* appropriate media resources.
4. Know and practice selected media *production concepts and skills.*
5. Know and practice effective *presentation delivery.*

When development and implementation of the course is completed, it will provide a strong background for other courses with visual communication components, and will be valuable for students in the three Department of Communication undergraduate majors as well as students in other majors throughout the university, including health science, education, business, industrial technology, arts and sciences and continuing education. This paper will describe how concepts and applications of visual literacy are introduced in the audiovisual media course, and how exercises and projects are used to reinforce that learning.

Fundamentals

General communication concepts are introduced first to give students an overview of the role of information in society, traditional communication components, and the relationships among components in communication systems. Of particular relevance to visual literacy in this discussion are communication concepts as they relate to creation and interpretation: These include: message/meaning, sender/receiver, encoding/decoding.

The *concept of literacy* is introduced in the second course presentation, considering both aural literacy and visual literacy. Literacy is defined simply as the learned ability to create and interpret messages. The students are asked to identify ways that they have been involved for most of their lives in formal or informal training to develop their reading/writing literacy. The discussion then turns to how they have developed a level of visual literacy, primarily how to "read" visual images, based more on experience than on any formal education or training.

To illustrate this, a series of 15 slides depicting a variety of subjects has been selected . The slides are shown sequencially, each for about 8 seconds. After viewing all of the slides, the students make a list of as many of the images as they can remember. On the average they remember 8 or 9, but in every class every image is identified by someone. Discussion of what they remember about the images first brings out a brief *identification* of an object or scene (e.g. a map, a flag, a person with a guitar standing by the sea). They then are able to begin to fill in more *descriptive details* (e.g. a flag with black and green stripes and a yellow field, a group of African natives posing for a picture, a skiier in a red parka jumping off a steep slope). Next, with encouragement, they make *inferences* about the image—still from the initial brief viewing (e.g. the flag is the type used to show persistence of vision and complimentary colors, the group is probably a family and appears to be undernourshed). Finally, they make comments about the *medium* in the slide (e.g. copy of a painting, line drawing, poster). At the end of the exercise the students are surprised at the amount and degree of sophistication of what they are able to remember and infer from such a short exposure to several images.

A second exercise is also used to help students recognize and exercise their visual interpretation and creation abilities. They are given 26 line drawings on separate small sheets of paper, and in groups they are told to sequence the visuals to tell a story—at first with no words. They then write a sentence or phrase with each image, and may include music or sound effects ideas. The writing gives them an initial opportunity to think about putting words with images, and helps them see that the visuals could tell the story quite adequately without the addition of words. In most cases the interpretation of the simple line drawings results in a story line and sequence very similar to the original, showing that even simple drawings can communicate rather complex meanings.

A *presentation development model* is introduced and discussed in the next two sessions. This is a very important structure which helps students approach the solution of media communication problems in a systematic way. The model, which we have developed over the past several semesters, has five major phases: IDENTIFY, DESIGN, PRODUCE, PRESENT, and ASSESS. We use the model as a basis for operationalizing the concepts of aural and visual literacy by considering how the creation and interpretation of messages is influenced in each phase of presentation development.

Audio Media and Non-Projected Visual Media (Print and Graphics)

Having introduced the students to fundamentals of media communication and aural and visual literacy, and having given them the framework of a model for media development, audio and visual media are introduced at the most basic level. For audio this involves design and production of a simple audio only message, and for visual media it consists of an introduction to print and graphic design and development of print messages (simple handouts) and other non-projected media (charts and graphs, and flip charts). Additional non-projected media that are introduced but not necessarily stressed include realia, models, replicas, facsimilies, miniatures, mock-ups, simulations, dioramas and prototypes. A brief hands-on experience with the Macintosh computer familiarizes students with its capabilities for producing headlines for paste-up and for layout of pages of text.

Visual design begins with a very basic understanding of the visual elements of balance, line, shape, space, texture, color, simplicity, legibility/readability and overall affect. Although most of the students do not consider themselves to be very artistic, once they begin working with these materials they show considerable interest and creativity. Materials and techniques for producing suitable lettering for presentation graphics are then presented, and the students are introduced to lettering terms including type face, font, point and pica as well as concepts such as appropriateness of fonts for the message, the necessity of simplifying the message, and using type to catch the viewer's eye. Finally, there is discussion and demonstration of presentation skills that can be used with non-projected media.

As a basic exercise in visualization of ideas, students are given a paragraph describing the results of a survey of the contents of garbage in U.S. municipal waste systems. They sketch three or four thumbnails of different ways to visualize the data, and then choose one of those approaches from which they develop a more complete sketch.

Projected Visual Media

Overhead transparencies and slides are treated as the major projected visual media, with opaque and filmstrip projection noted as less common formats. Treatment of these projected visual media includes concepts (function & format); production techniques and materials, with emphasis on visual design for each medium; techniques and settings for use of the medium; and evaluation of the medium.

The student project in this area is design and production of overhead transparency masters. The students are given two quotes from World Book Encyclopedia which describe the water cycle and acid rain. From these quotes they first visualize a single graphic to communicate the relationship of the concepts, and work up a rough sketch of their idea. They then produce the master for a base cell and at least one overlay, including both text and graphic elements. Their instructions are to turn in the sketch and good quality masters using principles and techniques of layout, legibility and design which they have just learned.

Integration of Visual with Audio Media

After the introductions to audio and visual media described above, principles and techniques for combining audio and visual media elements are discussed. Selecting appropriate visuals for a narrative script gives students a good first experience in integrating visual with audio elements, but is not too big a step from earlier visualization exercises. The element of this section of the course which is unique to our program is teaching and implementation of a system for selecting, designing or evaluating visuals on the basis of the way they function with respect to the narration and to one another.

A schema which was developed by Forrest Wisely and Edward Streeter[1] gives students a framework for making decisions about the role or roles a particular visual plays in an audiovisual presentation. The twelve visual functions are organized into three categories: affective, understanding and information processing. Of course, many visuals serve more than one of these functions in a well-designed audiovisual program, so primary and secondary functions are discussed.

Teaching the concept of integrating visual and audio media is begun by playing the audio portion of a sound/visual program. Immediately after listening, students are asked to relate any concepts and detail they remember from the program. They then view the program with both audio and visual elements, and discuss ways in which the visuals communicate additional information. After this general discussion of the contribution of the visuals, the students are given a script of the program. Several visuals are projected and the role each one plays relative to the narrative and to the surrounding visuals is considered. Finally, the functions of visuals are discussed as a means for evaluating the appropriateness of visuals in audiovisual programs.

Audiovisual Media (Production and Use)

The logical follow-up to the discussion of functions of visuals and visual scripting is production of a slide/tape program. The students are assigned to work in groups for this project, the emphasis of which is on the program's design, the way visuals are used, the way audio is used and the students' ability to bring all the elements together to make a presentable program. Course presentations in audiovisual media also include introductions to multi-media, television and film.

Developing Technologies

From year to year we review new technologies about which we feel students should be aware, but which are beyond the scope of the course. These may be technologies which are or will be addressed in a subsequent course, or which may be incorporated in this course as they become more commonly available in the business, medical and public organizations to which our students go. Some of those currently discussed are: desktop presentation, computergraphics, desktop publishing, interactive video, teleconferencing, CD databases, telefacsimile, and hypermedia.

Student Presentations

The culmination of the course is delivery by each student of a media-supported stand-up presentation of 8-10 minutes. The subject of these presentations is determined by the student, but they have to be on a how-to or why-to topic—not strictly informational. They select their topic and begin working toward the presentation early in the course when the topic and research segment of the development model is discussed. The presentations are evaluated not only on their use of visual and audio media in the presentation, but also on the documentation which they provide showing the planning process they used in preparing the media and the presentation itself.

Photographic Courses

Basic Photography and Publications Photography

The second level of six courses is divided into three areas of photographic, graphic, and electronic media. The photography area consists of two courses, Basic Photography and Publications Photography. These courses reinforce and develop visual communication competencies through the medium of photography. A detailed description about the content and approach of the Basic Photography course can be read in paper by Debra Drees in this book of readings.

Graphic Courses

Graphic Communication I

Graphic Communication I, which is mostly comprised of seniors and graduate students majoring in public relations, represents one of three university areas which offer a course in graphic communication. Besides the Department of Communication such courses are offered by the Art and the Industrial Technology Departments. The premise is that students taking a graphics course in the Art Department are primarily interested in the creative representation of ideas. They are the artists. Students in the IT Department are more interested in the equipment and techniques necessary for reproducing visuals through printing technology. The major interest of communication majors is the message to be delivered. It is important for them to understand what the artist and printer do, so that when they are planning a presentation or project they can make intelligent decisions and discuss options.

Like Audiovisual Media, the students in this class do not consider themselves to be very artistic or creative so the class is started with a segment called, "Learning to See Like an Artist." During this segment students first learn to do contour drawing and gesture drawing. Then an artists' model joins us in class and the students practice with life contour and gesture drawing. Finally the elements of drawing in perspective are presented. Of course, some students do better than others, but most agree that there is more to being an artist than they suspected. This exercise succeeded in helping them begin to look at things in a different way.

Theoretical elements are as important to the students of this class as are the practical elements. Discussions are held on perception, visualization, the classification of visual symbols, visual literacy, creativity, the Gestalt theory, figure-ground, typography and color. A significant new interest surfaced in the most recent class in the area of display media, particularly exhibition graphics such as mall exhibits, trade shows, exhibitions, theme parks, political displays and parades. Further, computergraphics has become a major interest as a tool in graphic communication. We are currently beginning basic instruction with simple Macintosh programs and encouraging students to get whatever practical experience they can, since there is not enough time in this course to explore in detail the possibilities of graphics, text, layout and other Macintosh capabilites.

Other topics and interests discussed in this course include producing catalogs and greeting cards, knowing and understanding different types, weights, and finishes of paper, and working with a printer toward a finished product. Students present a final project based on an area of personal interest. For the project they develop and produce graphic materials such as letterhead stationery, a logo, a color scheme or other promotional materials for an organization, cause or business. Alternatively they may develop a prototype of an exhibition display.

Graphic Communication II

Graphic Communication II a companion to Graphic Communication I, has not been taught for several years, but is now being redeveloped to reflect the needs and interests of today's students. This class will be taught using a problem-solving approach based on real-life situations which will lead students toward a specific graphic solutions. For each solution it will be required that students document all steps in the IDPPA model (ref: Audiovisual Media), with the addition of steps such as proposed budgeting and production time scheduling. The result will be a finished product or prototype of a finished product using the proper techniques and procedures.

Electronic Media

There are two courses in the visual communication curriculum which deal with what we categorize as electronic media: Non-Broadcast Television and Computer Graphics. Both of these courses are being reviewed as part of our visual communication development program, and are currently being taught in their traditional approach.

Non-Broadcast Television is not a production skills course. It is intended first to introduce students to a wide range of applications of the television medium in non-broadcast fields including training, medicine, education and independent production firms. It also deals in depth with the production process in non-broadcast settings including various production roles, program development and equipment configurations for studio, remote and post-production applications.

The primary visual aspects of this course which are being reviewed to see how they mesh with the visual communication curriculum plans include visualization of scripts, applications of electronic graphics and basic set design.

The other electronic media course, computer graphics, will require a complete redesign. It has been taught in the past as a cross-listed course by faculty in the Industrial Technology department. It is oriented toward CAD/CAM applications for graphic support of technical programs. We want to make the course one which will teach students to visualize ideas using computergraphics as a tool. Among plans for a newly renovated building for the communication department is a computer-based graphics lab, so we hope to be able to provide students with a significant experience in creating visually using the computer as a medium.

Integration Courses

The third level consists of two courses at the senior or graduate level. These courses provide students with opportunities to study and apply visual communication more in depth.

The **Theory and Research in Audiovisual Communication** course is designed for students to read and analyze research and other writings in the area of audiovisual theory and research. It is designed to help students consume the literature in the field and apply it appropriately.

The **Development of Mediated Messages** course's goal is to provide students with the opportunity to synthesize their coursework by working with a real world problem. A number of clients both within and outside the university are identified who need help with some form of communication problem. A student or group of students is assigned to work with the client to design and develop an appropriate mediated solution to their problem. Students work with clients in business, government, social agencies, and educational institutions.

Conclusion

This project is in various stages of development and implementation. It is a large and complex project requiring a significant commitment of time and resources. We feel it is a very important activity in light of developing communication technologies and the changing demands of the various career positions our graduates fill.

Learning To Look: Reversing Strategy for Perceptual Change

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Introduction

Visual challenge exercises can be effective as a means of teaching the concept of reversing, which may develop perceptual flexibility. The term visual challenge is used here to describe experiences with visual stimuli which focus and actuate capacities to grasp, interpret, and use visual form. This differs radically from visual stimulation which does not spur perceptual and cognitive responses, in fact may blunt these responses. In the rapidly expanding information environment, additional methods of discriminating and grasping visual information are needed.

Using the perspective of the visual arts, a visual challenge strategy is demonstrated for reversing. It employs figure/ground perception as the concept in the demonstration slides, and suggests problems for student involvement.

Visual Arts & Visual Thinking

The goal of teaching art for perceptual flexibility and the development of visual thinking is basic to art education, and directly related to the concept of visual challenge. The visual arts instill forms of thinking which can enhance problem solving and thinking in other areas.

Visual thinking is considered non-domain-specific thinking, and appears to be the same kind of creative thinking that grounds scientific investigation. Visual thinking includes analysis and synthesis, and could be described as synaesthetic and holistic. Visual thinking involves both intuitive perception and intellectual analysis, both common to creative activity.

The term visual arts is intended to include visual objects produced by artists, as well as visual objects designed by technology, crafts, or other areas of visual design. In our world of images, visual learning and education through art can enhance skills in understanding, creating and communicating withimages. Experiences with art encourage differing ways of conceptualizing, and a kind of knowing that uses many forms of thinking skills.

Visual Challenge & Perceptual Change

Art education research has utilized various strategies in teaching art for perceptual change. Strategies included experience in making art, looking at art, talking about art, training in scanning, and aesthetic criticism & analysis of art by experts. Random experiences in making, looking at, or analyzing art may provide visual stimulation, but not necessarily visual challenge and perceptual learning.

Arnheim (1986) cites the need to distinguish between sensory stimulation and perceptual challenge in art education. While both are legitimate resources of the human mind, the difference could mean art experiences which provide only more visual stimulation, or those that possess order and permit creation at a level manageable by the student. He suggests that more perceptual challenge is needed, whereas too much sensory stimulation may blunt perceptual and cognitive responses.

Visual challenge strategy recognizes the interaction between the visual stimuli, student and teacher. The visuals in the slide presentation are based on organizational principles, particularly figure/ground phenomena. This visual principle is used to demonstrate the concept of reversing.

Comparative Analysis

A key part of the demonstrated visual challenge strategy is the use of comparative analysis. The visual stimuli are shown in comparative pairs and series, specifically juxtaposed to exploit the tendency to search for similarities and differences. The opportunity to compare and contrast can help to gain insights, discern & appreciate differences, and heighten aesthetic awareness. Gardner refers to 'illuminating comparisons' in the arts (Henle, 1976). In that discussion which dealt with an exhibition of art originals and forgeries shown together, he stated that "All judgement, all evaluation, necessarily presupposes and depends upon comparison" (p.107). Comparative analysis leads to discrimination. For example, maps are not simply quantitative, they show relationships in position, size, and shape of countries.

The visuals which demonstrate this concept include a wide variety of comparisons, various categories of differences and similarities, and supplementary information. These provide alternate ways of illuminating and describing the same concept, and invite comparative analysis.

Reversing / Flexibility

The ability to reverse allows one to see 'the other half' of the world. It enhances perceptual flexibility, and has been correlated with creativity and problem solving. Reversing facilitates awareness of alternatives, new relationships, differing viewpoints, and mental transformations. Transformations take a kind of thinking that is not linear or fixed. Alternative transformations allow flexibility of perception, and are an integral part of the creative process.

One approach to reversing and perceptual flexibility in design can be explored by considering the figure/ground phenomenon in visual perception. One can learn to discriminate more of the whole (the other half) by learning to see the ground as well as the figure. Perception, communication, visual analysis and synthesis are facilitated.

Figure/Ground

A basic phenomenon of visual organization which lends itself to the concept of reversing is that of figure and ground. The principle of figure/ground is common to all of the visual arts. The perception of art, and most else, deals with the organization of the visual field into figure and background, i.e. figure/ground. Factors governing visual organization were identified by the Gestalt school of psychology in the early 20th century. The movement originated in Germany about 1912, and was led by Max Wertheimer. The gestaltists provided evidence on the organization and grouping of visual elements, and their perception as wholes. They maintained that the whole is different from the sum of its parts. Wertheimer showed that a perceptual pattern is accounted for by tracing the relations between elements, and by describing the overall structure of the pattern.

We see by making discriminations. We make visual discriminations by comparison, and the first step in perception is distinguishing figure from ground. This discrimination gives shape and form to our visual world. In this fundamental discrimination, figure and ground can be seen sequentially, but not simultaneously. Perhaps once a figure is distinguished, we become complacent, and are not motivated to discern the ground or alternative figures.

The following illustrated discussion of figure/ground is meant to enhance awareness of the concept of reversing. It deals with a few of the concepts presented in the comprehensive set of slides.

Throughout visual arts history, artists have been aware of, and manipulated figure and ground. Often referred to in the arts as positive/negative shape, it is the most essential operation in visual perception, and fundamental to art forms. Artists and designers study and utilize the various interrelationships of figure/ground, background/foreground, and object/surroundings. In the most general sense, all works of visual art are variations of the figure/ground relationship.

The Danish psychologist, Edgar Rubin, developed the famous vase-face illustration (Koffka, 1935) to demonstrate the properties of the figure/ground relationship. In examining a vase-face and the other illustrations in Figures 1 and 2, some determinants of the figure/ground relationship can be demonstrated. A single line can delineate figure. It can serve as a contour boundary which could be interpreted different ways, dependent on which area is identified as figure.

The ambiguity of figure and ground has interested many visual artists. The visual tension and fascination of such ambiguity has been explored in various ways. The illustrations in Figures 3 and 4 include examples of student designs which expand upon this phenomenon.

Of the many visual phenomena which can arouse visual interest, figure-ground reversal is especially evocative. Figure 5 shows a pair of images in which the black & white areas have been purposely reversed. Examples that offer probability of either black or white being seen as figure are illustrated in Figure 6. In the visual arts, an equivalent reversal image is referred to as a counterchanging or alternating design. This technique is used in the fine arts, decorative arts, and graphic arts.

While free to select or determine which part of a design is figure and which is ground, visuals are often designed to impel the viewer to read them in a particular way. Differing situations also affect what is seen, and persons see different things, often depending on the context presented. We usually identify an object on a background. Other factors which contribute to our perception of figure on ground are size, proximity and contrast. Often it appears that the smaller an area of space, the greater the possibility that it will be seen as figure. The distance between parts of a design affects which areas will be seen as figure and ground. In many designs, all three factors can be seen in interplay. Designs are often planned to be 'read' in more than one way.

Knowing more about the phenomena of figure/ground, only a part of the language of visuals, does not by itself make one visually literate or change our perceptions. Our awareness of the concept of reversing could be enhanced by additional experience with visually challenging exercises which demonstrate the figure/ground phenomenon. One such exercise was the slide

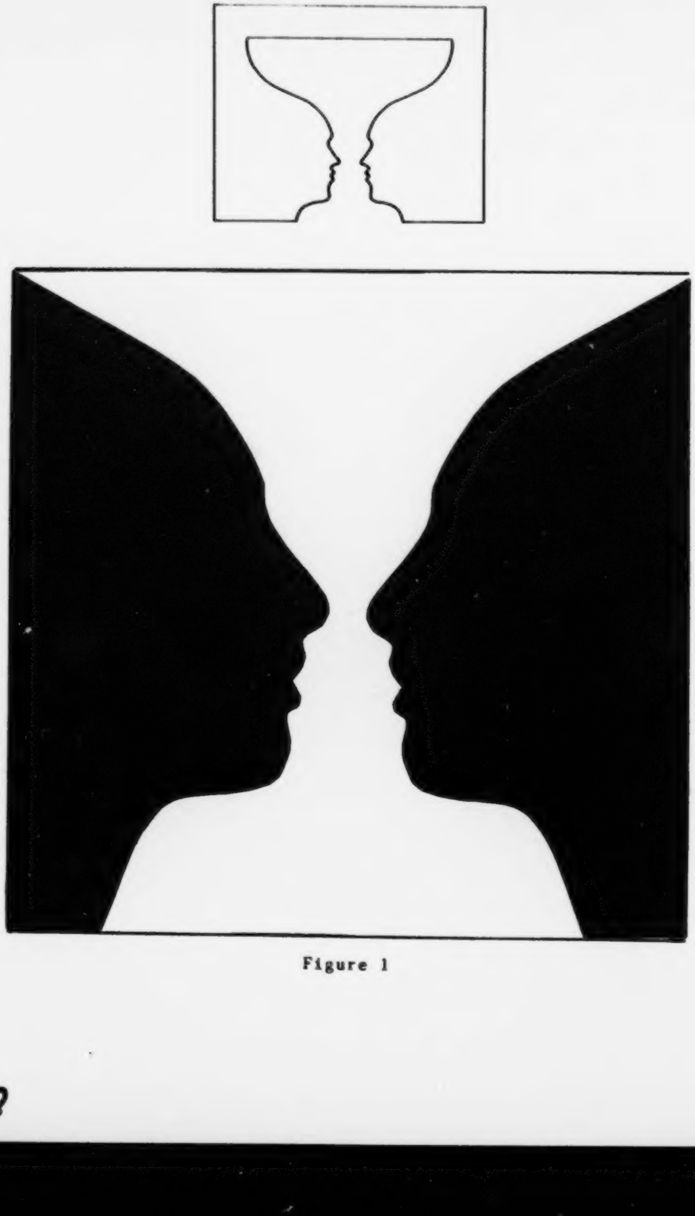

Figure 1

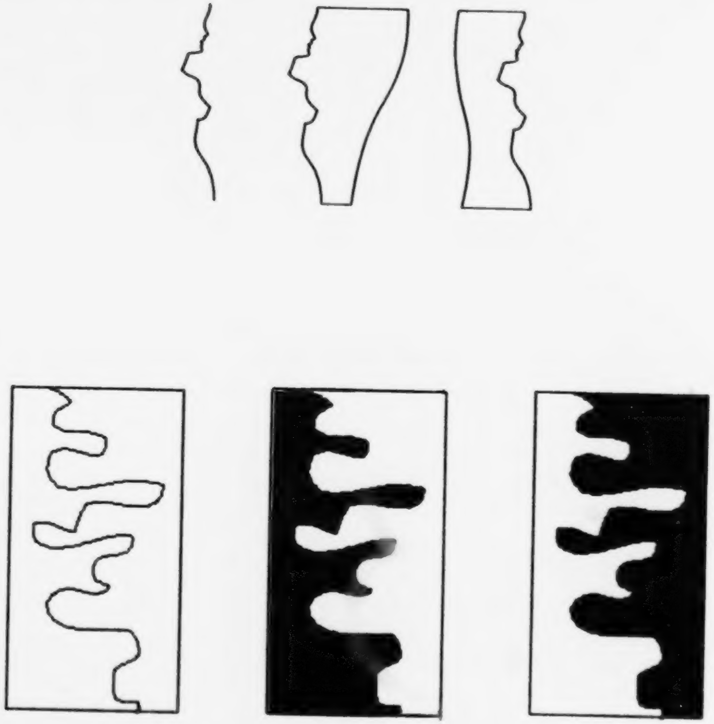

Figure 2

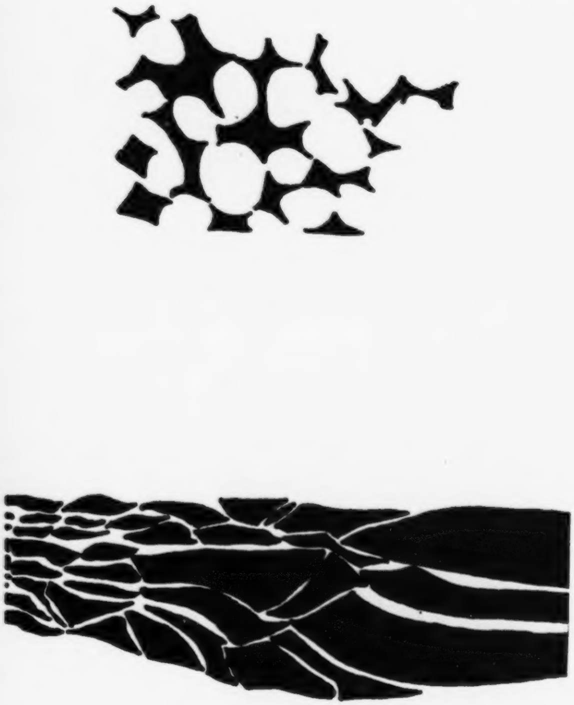

Figure 3

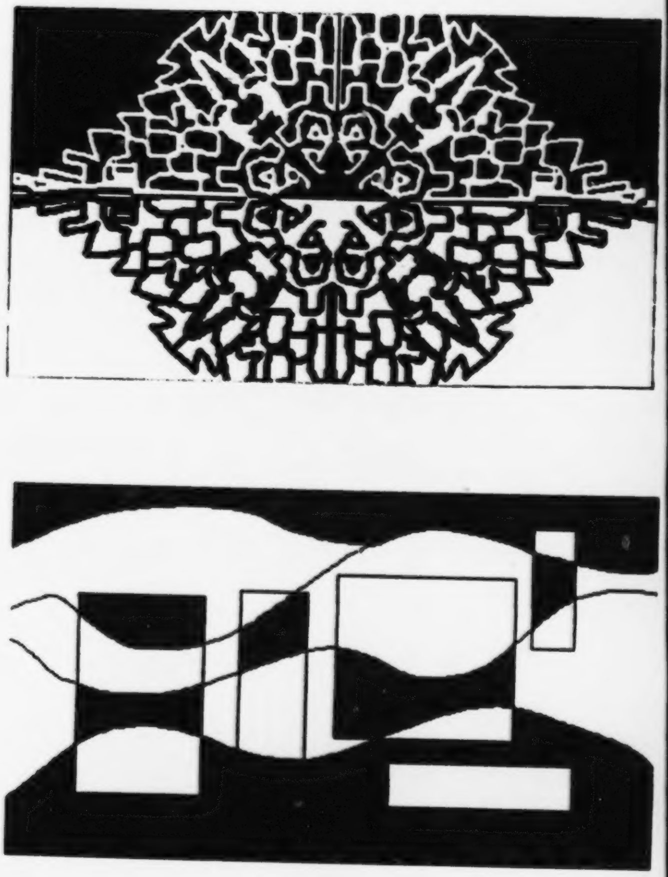

Figure 4

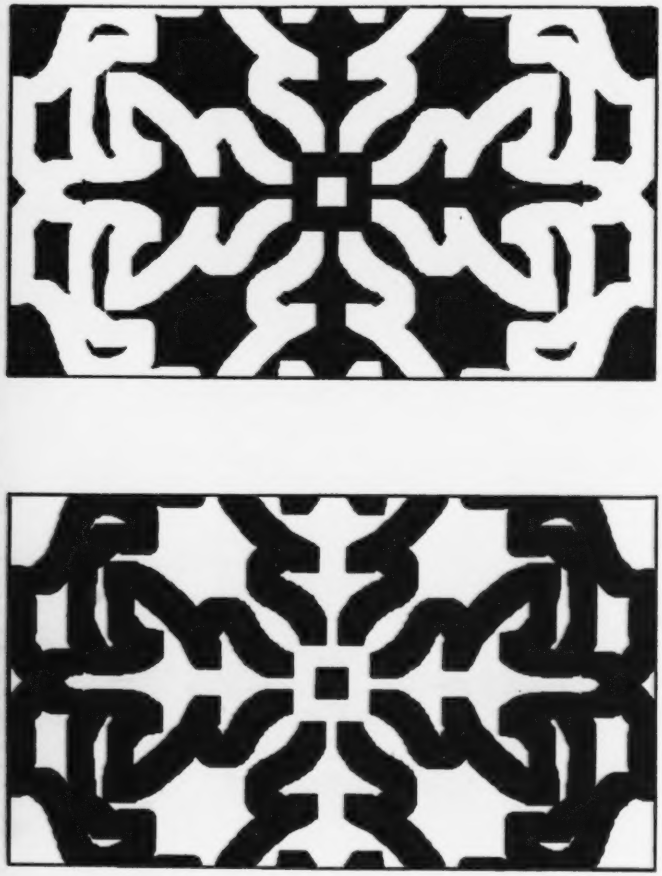

Figure 5

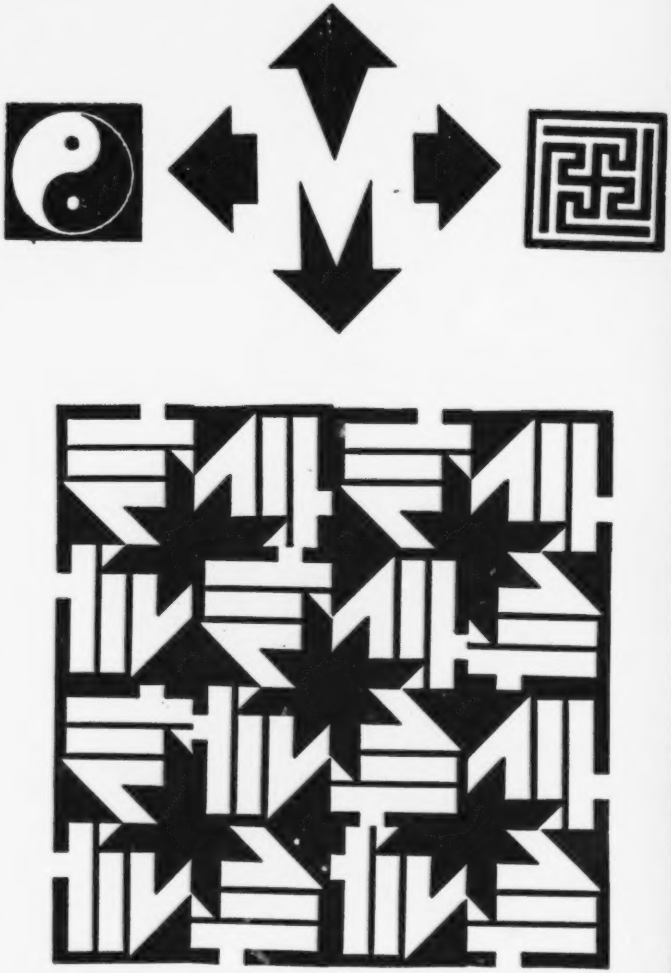

Figure 6

program which was the core of this presentation. It consisted of 60 pairs of images, projected side-by-side for comparative analysis. The images were chosen to provide visual challenge, and encourage perceptual flexibility.

Creativity & Problem Solving

One aspect of perceptual growth, creativity and problem solving is the flexibility with which we see things. Creativity has been defined as looking at one thing and seeing another.

While there is no unified definition of 'creative seeing' or 'perceptual flexibility', certain traits emerge in the multitude of studies of the creative process, creative people and creative products. A number of these traits appear repeatedly in the literature, they include flexibility of perception, reversing and alternating, changing perspective and viewpoint, and divergency.

A significant concept is the creative process as a change in perception. Seeing things in new ways can lead to the discovery of ideas and the solutions to problems. This paper proposed the strategy of visual challenge exercises as training for the concept of reversing, demonstrated in the figure/ground phenomenon. It could help us see things in new ways, to develop perceptual flexibility, and lead to alternative recognitions, approaches, and solutions. There is not one of us who could not profit from the education of our vision.

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The Additive Effect of Visualization and Overt Response/Visual Feedback in Facilitating Student Achievement of Different Educational Objectives

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Introduction

Researchers are constantly attempting to identify instructional strategies which may be prescriptive in facilitating student achievement of different types of educational objectives. This has resulted in a wide variety of learning aids being embedded in verbal/oral instruction to improve students' information processing, their understanding and their affective responses to the instruction. Recent research (1) has found evidence that there is not a direct relationship between the number of learning aids employed in an instructional sequence and the amount of learning that occurs. This is due in part to the fact that human beings are limited in the amount of information they can actually process in a given amount of time (2,3,4,5).

Visualization (1,6,7,8) inserted questions (9,10,11,12,13) and feedback strategies (14, 15) used independently have all been successfully employed to facilitate student achievement of different types of educational objectives. The purpose of this study was to investigate the additive relationship between visualization and visualization complemented by means of inserted questions and overt response and visual feedback, in terms of their instructional potential for enhancing students' achievement of specific types of educational objectives.

Additionally, this study attempted to implement Hartman's (4, p. 29) combined theory of cue summation and stimulus generalization which contends that:

> ...together, they predict that an increase in the number of cues available in the presentation of information increases the recognition or discrimination of that information, provided the cues are also available in the situation wherein the discrimination is tested.

The cue summation portion of the study was implemented by employing similar strategies across treatment groups, and the stimulus generalization hypothesis was maximized by utilizing the visual test format as the dependent variable.

Statement of the Problem

Specifically, the objectives of this study were to

1. examine the instructional effectiveness with which visualization could be used in an instructional presentation to facilitate student achievement of different types of educational objectives:
2. to determine the effect of embedding additional types of instructional strategies (inserted questions, overt responses and visual feedback) in visualized instruction in terms of subsequent student achievement on tests measuring different types of educational objectives.

Procedures and Treatments

The sample population consisted of one hundred and ten undergraduate students enrolled at The Pennsylvania State University. Students were randomly assigned to one of the three treatment groups. The content used was a 2,000-word instructional unit describing the human heart; its parts, and the internal processes which occur during the systolic and diastolic phases (1,6,7). Each treatment was developed in a self-paced instructional booklet format. Treatment I was considered to be the control treatment. This treatment consisted of textbook-like booklets with verbal instruction and verbal labels (Figure 1). Students receiving this treatment interacted with the instructional script complemented by the verbal labels; no external rehearsal strategy was embedded in this treatment. Students receiving Treatment II, the visualized treatment, received the same instruction as did students in Treatment I; however, this treatment included visualization designed to illustrate the verbal information being presented. The visualization was designed to reinforce relevant or important information located on that particular page (Figure 2). Students in Treatment III, the overt visual treatment, received the same instructional format as did students in Treatment II; however, students were asked specific questions about the visual content being presented which required that they make an overt verbal response on the worksheet provided. They then were to turn the page of the instructional booklet to see if they answered correctly. If the student answered no to the question when the correct answer was yes, the upper corner of the next page (which repeated the correct visualization and contained the verbal caption "Picture Correct") served to reinforce the student by providing knowledge as to the correctness of their response. The student was then instructed to cross out the incorrect answer on the worksheet with a red pencil and then circle the correct answer. This same type and function of feedback was provided when the student answered yes and the correct answer was no (under this condition the feedback visual would say "Corrected Picture").

If the student answered no to the inserted question and the correct answer was no (the picture did not match the verbal description), the upper left corner of the next page (which contained the corrected visualization and the verbal caption "Corrected Picture") informed the student that this answer was correct. For example, in Figure 3, Plate 1, the visualization does not match the verbal description because the mitral valve is designated (on the visualization) to be on the right side of the heart. In the verbal description the mitral value is said to be located "between the left auricle and the left ventricle." In the left-hand corner of the next page, the corrected picture shows the mitral valve to be on the left side of the heart (Figure 3, Plate 2). This provides the student with the knowledge of the correct response and a correct visual example of the content. This same type and function of feedback was provided when the student answered yes to a question which had yes as its correct answer (although in this situation, the feedback illustration would indicate that the picture was correct).

PULMONARY
VEINS

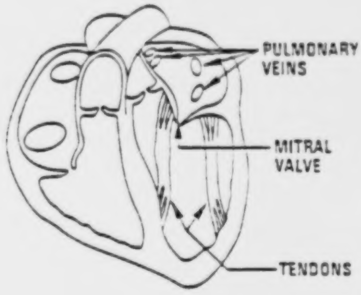
MITRAL
VALVE

TENDONS

Returning from the lungs, the blood enters the heart through four pulmonary veins and collects in the left auricle, these vein openings, like the vena cavas, have no valves. The left auricle contracts when it is full, squeezing blood through the mitral valve into the left ventricle.

The mitral valve, located between the left auricle and the left ventricle, is similar in construction to the tricuspid valve. As the left ventricle contracts simultaneously with its mate, the right ventricle, if forces blood behind the flaps of the valve, thereby closing the passageway back to the left auricle Like the tricuspid valve, the ends of the mitral valve have flaps which are anchored tothe floor of the left ventricle by slend tendons.

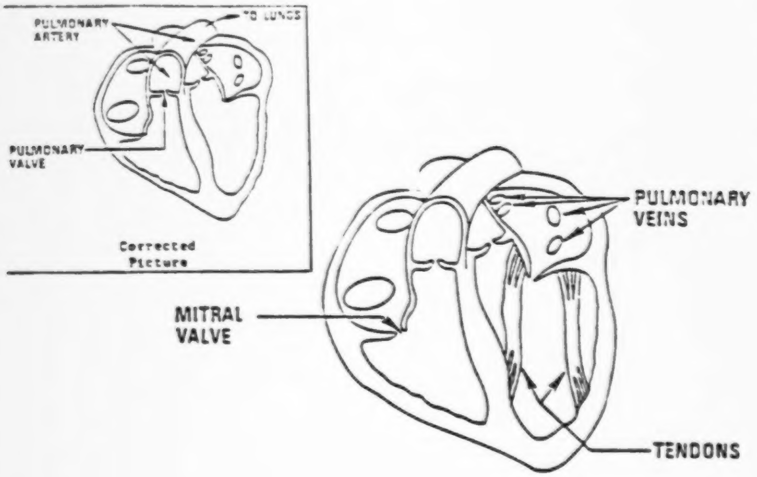
FIGURE 1. Sample of Instructional Treatment I.



Returning from the lungs, the blood enters the heart through four pulmonary veins and collects in the left auricle; these vein openings, like the vena cavas, have no valves. The left auricle contracts when it is full, squeezing blood through the mitral valve into left ventricle.

The mitral valve, located between the left auricle and the left ventricle, is similar in construction to the tricuspid valve. As the left ventricle contracts simultaneously with its mate, the right ventricle, it forces blood behind the flaps of the valve, thereby closing the passageway back to the left auricle Like the tricuspid valve, the ends of the mitral valve have flaps which are anchored to the floor of the left ventricle by slender tendons.

FIGURE 2. Sample of Instructional Treatment II.



Returning from the lungs, the blood enters the heart through four pulmonary veins and collects in the left auricle; these vein openings, like the vena cavas, have no valves. The left auricle contracts when it is full, squeezing blood through the mitral valve into the left ventricle.

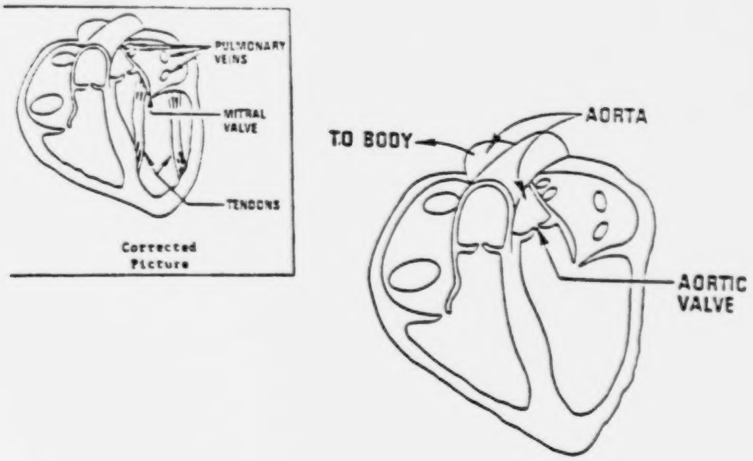
The mitral valve, located between the left auricle and the left ventricle, is similar in construction to the tricuspid valve. As the left ventricle contracts simultaneously with its mate, the right ventricle, if forces blood behind the flaps of the valve, thereby closing the passageway back to the left auricle. Like the tricuspid valve, the ends of the mitral valve have flaps which are anchored to the floor of the left ventricle by slend tendons.

7. Does the picture of the heart in the *upper right corner* correctly illustrate the printed material you just read on this page?

   a. yes
   b. no

   Look at the picture on the upper left corner of the next page to see if you answered correctly.

FIGURE 3, Plate 1, Sample of Instructional Treatment III.



The contraction of the left ventricle pumps the blood through the entire body. For this reason it is the largest, strongest, and most muscular section of the heart. When the left ventricle is filled with blood, it contracts, resulting in pressure which opens the aortic valve. The aortic valve is similar to the other flap-like valves; the valve stops the backward flow of blood to the left ventricle and opens for the forward flow of blood to the aorta.

The aorta is the large artery which carries and blood away from the heart back to the various parts of the body.

8. Does the picture of the heart in the *upper right corner* correctly illustrate the printed material you just read on this page?
   a. yes
   b. no

Look at the picture on the upper left corner of the next page to see if you answered correctly.

FIGURE 3, Plate 2, Sample of Instructional Treatment III.

Criterion Measures

An eighty-item visualized criterion test developed by Dwyer (16) which consisted of four subtests was administered to students immediately after completing their respective instruction. The tests (excluding the Drawing Test) consisted of simple line drawings as answers and distractors in a multiple choice format. Figure 4 contains a sample item from the visualized test. The following description of the kinds of performance measured by the criterion tests illustrates the kinds of educational objectives that were assessed.

44. The part of the heart in which the contraction impulse starts:

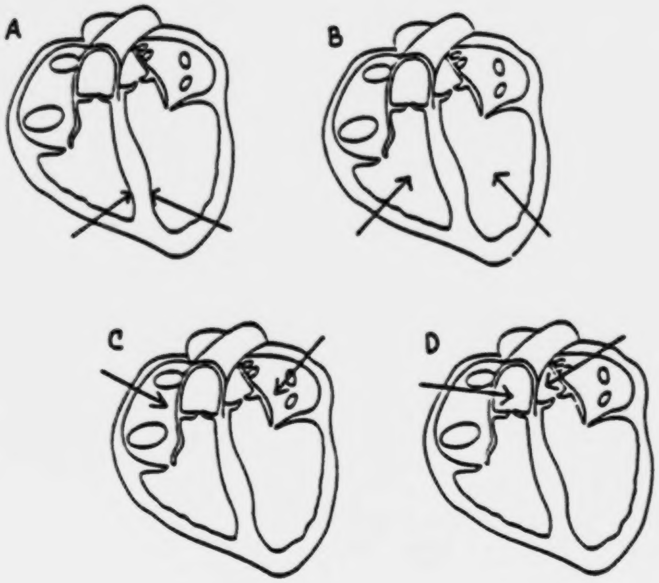


FIGURE 4. Sample of Visualized Criterion Test.

Drawing Test

The objective of the drawing test was to evaluate student ability to construct and/or reproduce items in their appropriate context. For example, the drawing test (N=20) provided the students with a numbered list of terms, e.g., 1) superior vena cava, 2) aorta, 3) tricuspid valve, 4) pulmonary vein, etc., corresponding to the parts of the heart discussed in the instructional presentation.

The students were required to draw a representative diagram of the heart (a symbol like a valentine sufficed; the quality of the drawing did not enter into the scoring) and place the number of the listed parts in their respective positions. For this test the emphasis was on the correct position of the verbal symbols with respect to one another and in respect to there concrete referents.

Identification Test

This multiple choice test (N=20) required students to identify the numbered parts or positions on a drawing of the heart. Verbal labels were each accompanied by five simple-line drawings of the heart, each with an arrow pointing to a different part. Students were required to match the verbal label with the appropriate visual alternative.

Terminology Test

This test was designed to measure students' knowledge of facts, definitions, and specific terms. For each of the twenty multiple choice items a short description of a part or position was provided along with a simple-line drawing of the heart. Labeled arrows printed to the different parts and students were asked to select the part of the heart to be identified-described.

Comprehension Test

The comprehension tests consisted of twenty multiple-choice items. Given the location of certain parts of the heart at a particular moment of its functioning, students were asked to locate the position of other specified parts of the heart at the same point in time. This test required that students have a thorough understanding of the heart, its parts, its internal functioning, and the simultaneous processes occurring during the systolic and diastolic phases. The comprehension test was designed to measure a type of understanding that occurs when the individual understands what is being communicated and can use the information being received to explain some other phenomenon occurring simultaneously. This test also provided visual distractors in the multiple choice format. Students were required to select the visualized option most appropriately answering the question's item.

Total Criterion Test

Scores received on the four individual criterion tests were combined in a composite 80-item test designed to measure total understanding of the concepts presented.

Design

Visualization and type of feedback were considered to be the independent variables. The dependent variables were student achievement of the drawing, identification, terminology and comprehension tests. Students were randomly assigned to treatment, received their respective treatments and the criterion tests in one session. Students were permitted to proceed through the instructional unit and criterion tests at their own pace.

An analysis of variance was conducted on the scores achieved by the students in the treatment groups for each criterion measure. Where significant F ratios (0.05) were found to exist, differences between pairs of means were evaluated using Tukey's WSD Paired-t Test.

Results

Table 1 illustrates the number of students in each treatment group and the means and standard deviations on the criterion tests. Kuder-Richardson 20 reliability coefficients for the criterion tests were Drawing, 0.89; Identification, 0.84; Terminology, 0.79; Comprehension, 0.76; Total Criterion, 0.95). Analysis of variance conducted on the mean achievement of the three treatment groups revealed that significant differences existed on all criterion tests (Table 2). Follow-up analysis on the criterion tests indicated that, in general, the visualized treatments, Treatment II and Treatment III, were significantly more effective than the non-visual treatment (Treatment I). Results also indicated that insignificant differences existed between the two visualized treatment, Treatment II and Treatment III (Table 3).

TABLE 1 Means and Standard Deviations on the Criterion Tests for Students Receiving the Varied Instructional Treatments

	CRITERION TESTS				
Treatment	Drawing	Identification	Terminology	Comprehension	Total Criterion Test
I. Control: No	Mean= 10.29	Mean= 12.31	Mean= 9.46	Mean= 9.80	Mean= 41.86
Visualization	SD= 5.60	SD= 4.55	SD= 4.18	SD= 3.56	SD= 15.77
II. Covert Visual	Mean= 14.72	Mean= 16.03	Mean= 12.28	Mean= 12.9	Mean= 55.95
(N = 39)	SD= 4.53	SD= 3.65	SD= 3.59	SD= 3.48	SD= 13.66
III. Overt/Visual	Mean= 13.28	Mean= 15.44	Mean= 11.97	Mean= 11.33	Mean= 52.03
(N = 36)	SD= 4.79	SD= 3.32	SD= 3.72	SD= 4.22	SD= 14.77

TABLE 2 Analysis of Variance on the Criterion Tests

Source	SS	DF	MS	F	P< .05
Drawing Test	372.8	2	186.40	7.32	*
Error	2726.3	107	25.48		
Identification Test	287.5	2	143.73	9.38	*
Error	1639.4	107	15.32		
Terminology Test	172.7	2	86.35	5.73	*
Error	1611.6	107	15.06		
Comprehension Test	180.2	2	90.11	6.20	*
Error	1556.4	107	14.55		
Total Test	3845.0	2	1922.6	8.63	*
Error	23835.0	107	222.8		

TABLE 3 Pair-wise Contrasts: Summary of Tukey's WSD Follow-Up Technique on Individual Criterion Measures

Criterion	T-T	Diff	Obtained t Statistic	df Value	Critical value of t ($p < .05$)
Drawing Test	2-1	4.44	3.78*	107	2.38
	2-3	1.44	1.23	107	2.38
	3-1	3.00	2.50*	107	2.38
Identification Test	2-1	3.71	4.07*	107	2.38
	2-3	.58	.64	107	2.38
	3-1	3.13	3.37*	107	2.38
Terminology Test	2-1	2.28	3.12*	107	2.38
	2-3	.31	.35	107	2.38
	3-1	2.51	2.73*	107	2.38
Comprehension Test	2-1	3.12	3.51*	107	2.38
	2-3	1.59	1.80	107	2.38
	3-1	1.53	1.69	107	2.38
Total Criterion Test	2-1	14.09	4.05*	107	2.38
	2-3	3.92	1.14	107	2.38
	3-1	10.17	2.87*	107	2.38

Discussion

The findings of the present study indicate that the incorporation of visualization into an instructional sequence can significantly improve student achievement of a variety of different educational objectives. However, insignificant differences were found to exist between Treatment II (visualization) and Treatment III (visualization with an overt response and visual/verbal feedback. This would seem to indicate that merely adding additional interactive strategies to visualized instruction does not enhance learning. It would also imply that a difference (the overt verbal response and visual feedback (Treatment III) added to the visualized instruction (Treatment II) to be a difference has to make a difference and that differences that do not make a difference are functionally identical. Additionally, there is considerable prior research dealing with the effects of covert and overt practice (rehearsal) of the type employed in this study which typically reports insignificant differences between the two (17, 18). There is also the possibility that a curvilinear relationship exists between information acquisition (learning) and the number and type of interactive strategies embedded into an instructional sequence. It may be that students became so preoccupied with writing the responses to the questions, checking and correcting their answers, and examining the validity of the visual feedback that they neglected to synthesize and integrate the information being presented (1).

It was hypothesized that those students who received Treatment III, where they were required to make an overt response and respond to visual feedback, would profit maximally from the experience. The overt response and the interaction with the visual for response conformation was to ensure their interaction with the relevant content information needed for achievement on the criterion tests. This did not occur; in fact, the differences in student performance between Treatment II and Treatment III were insignificant. The logical conclusion might be that adding additional interactive strategies to visualized instruction is dysfunctional; however, if you examine the level of the mean achievement obtained by students on the individual criterion test (Table 1) it is apparent that students acquired a little over half of the information tested by the criterion measures. Apparently, the type of interaction (practice) provided by the overt response and visual feedback was not strong enough to intensify the information processing necessary to move the intended information from short-term memory into long-term memory. It is also possible that this type of interaction may have had the opposite effect. Students may have perceived the questions and answers all they needed to know about the content being presented and neglected to interact with other substantive information on each frame.

In general, the findings from this study indicate the visualization properly embedded in instructional content can significantly improve student achievement of different types of educational objectives. It also revealed that "minor" embellishments added to visualized instruction will not necessarily enhance student achievement in a linear relationship. It appears that sustained research employing more intense integration strategies where students are given the opportunity to interact and practice optimally is needed if instruction is to be designed routinely to accommodate varied audiences and to maximize their achievement of different types of educational objectives. (1).

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Drawing on the Iconic Process from Within and Without: Enhancing Memory, Logic & Creativity

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Introduction. Students in recent years have been exposed to intense multisensory experiences outside the classroom through various media available to them. They have been emersed in images, sights, and sounds through technology in modern communications in a simultaneous and global manner during leisure-time activities.

Upon examination of the curriculum of elementary and secondary schools youngsters, there continues to exist a major emphasis on processing information in a linear, sequential, verbal way alone. To bridge the gap between life outside the classroom, technological advances, and actual educational practice, a structured systematic plan and corresponding effort is needed to integrate the verbal aspects of education with the nonverbal.

Although there still remains controversy among psychological and educational interpretation of the physiological research on the brain, particularly as to hemispheric specialization, there is much agreement about the processing of information or cognitive style of individuals; generally, that for most people the processing of the left hemisphere is characterized by analysis, logic, and linear sequence; and the right hemisphere is characterized by creative, intuitive, global, and simultaneous processing. Although individuals are processing in both hemispheres all of the time, it is agreed that the majority have hemispheric preferences when receiving, storing, and retrieving information.

During the past thirty years, knowledge about the human brain has dramatically increased. But it is still believed that we know only about one percent of what there is yet to know about the complex organism. Although much of the research is tentative, it would be a mistake for educators to ignore the work of the neuroscientists.

There is considerable evidence that schools are focusing most of their attention on the left verbal mode (reading, listening, talking, writing) with little attention to right non-verbal activity such as creativity, visualization,, intuition, art, and music. Although both hemispheres of the brain do seem to process information differently, the interconnecting network of nerve fibers (corpus collosum) allows the cooperation and collaboration of the two hemispheres when an optimal learning environment is provided.

When choosing this optimal environment for improved learning, it is necessary to go beyond the conscious mind, and incorporate feelings, intuition, and imagination. When conscious and subconscious intelligences are involved learning will be more effective and effecient.

Cognitive, affective, and psychomotor factors need to be integrated in all individual and group experiences. Cognitive activities deal with how the mind processes information; what a student learns and how he learns it. Feelings and attitudes are affective; how a student perceives and values his environment falls under this rubric. Psychomotor qualities involve physical movement responses; how a person uses kinesthetic tactile senses in responding to the environment. When there is an integration of these areas in the educational process, students of all ages are more apt to be life-long learners.

Although students do have varying perceptual preferences in learning style, educational experiences that tap all modalities are certain to be most productive. The more multisensory experiences that are used, the more personal development will be enhanced. When multimodal activities are incorporated, the student not only has an opportunity to respond in his area of perceptual strength, but will also sharpen secondary and tertiary modalities.

The message to educators is clear: stimuli and information should be presented in such a way that students can develop flexibility in using at will both hemispheres. When activities are presented to one hemisphere or the other and that hemisphere acts on that information, it is strengthened. Conversely, when one hemisphere is neglected, it is weakened. When thought and imagination are blended, optimal learning occurs.

One of the most effective and efficient ways to achieve this balance is through the use of visual strategies to enhance the much valued verbal/cognitive learning so eminent in the Western system philosophy of education. Since it is estimated that ninety percent of all information received comes through the eye, it behooves educators to demonstrate to students the visual metacognitive strategies which can accelerate learning as competition in this global society accelerates.

Visual representation is an enhancement to any lesson at any level. When visual strategies are utilized both verbally and non-verbally a better balance in cognitive style is achieved. Visual/verbal representation includes words, phrases, or sentences.

Visual/nonverbal includes such representations as drawings, paintings, graphics, symbols, dramatization, and movement. All new and/or difficult information should be presented in each way so that students will have an opportunity to work in their area of strongest hemispheric preference as well as developing cognitive style flexibility by using secondary hemispheric preferences.

Mental Imagery

Visualization has provided the impetus for profound contributions from many great thinkers. Aristotle felt that thinking was housed in images that reflected inner knowledge and unveiled emotions. Pythagoras taught his students to solve problems by deliberately evoking dream imagery. Einstein solved complex problems through his ability to perceive inner images. Kekule discovered the molecular structure of benzene while imagining a snake swollowing its tail. The abilities of great thinkers and others like them, including conscious psychologists, seem to validate the belief that "thinking in pictures precedes thinking in words." For this reason many educators are turning to visualization techniques to prepare students for learning more effectively.

The ability to create pictures in the mind is strong in young children. This process of visualization becomes more inhibited for many as students progress through school and thereafter. Preschool and in the early grades children allow images to happen spontaneously as they observe and interact with their surroundings. As children experience more structure, restrictions, and the demands of authority figures, as they advance through the grades, there is little support of enhancement for creative imagery. In fact, the characteristics that made young children such natural learners are often disapproved of and therefore, the natural tendancies to explore, discover, make mistakes, visualize, and fantasize about learning, which is natural rehearsal, becomes inhibited.

Everyone can experience mental images of some type. Of those who tend to use this capacity, at least eighty percent appear in color; movement occurs in approximately forty percent; and many experience images that fade in and out.

Special experience is not needed to recapture the once instinctive ability to visualize. However, the immediate internal and external environment is important for success. A positive frame of mind, a receptive stillness, and relaxed attention must exist for images to surface optimally. Students should be alert, but not anxious and should be concentrating within and not be involved with the conscious senses of that is happening around them. In this way, the creative senses will be more accessible.

Because of the need to focus, most students need a quiet outer space. But is is important to keep a balance between relaxation and alertness. If too focused, the student will become rigid and if too relaxed, the student will fall asleep. A sense of expectancy needs to prevail--a sense that something pleasant and wonderful is about to happen.

There are numerous techniques to achieve this condition of relaxed alertness such as slow deep breathing, quiet meditation, recalling mentally a pleasant experience or good feelings, or playing unobtrusive Classical or Baroque music. Whatever the technique, before movies of the mind are created, the bright lights of the theatre should be dimmed. In this way the inner dialogue which is so often present will be somewhat repressed to allow the imaginative senses a release.

Since inner movies hold all of the experiences and feelings, it is important to learning and to success to have them available at will. But with the inner chit-chat that exists, it is easy to block out feelings, intuition, and as a result creativity. Trying to deter the inner dialogue is not easy, because the conscious messages keep creeping in. This is unproductive when creativity is called upon. However, relaxation techniques prior to visualization (or any creative endeavor) will facilitate it; and the more visualization is used, the easier it is to recall at will. To recall imaginative senses at will is a key objective in a balanced learning environment.

The use of imagination to enhance learning, even though not provided for in many school environments, is widely accepted today. Daydreaming, fantasizing, making movies in the mind are not viewed as a waste of time as they once were, but a valuable tool in the learning process as pupils clarify their knowledge, experiment with it, and experience the joy.

Conscious and unconscious imagining can change the quality of learning behavior of a student. To affect the positive use of imagery, imagery needs to be structured to accomplish specific purposes. Imagery is a powerful tool and should not be used indiscriminately. Whether the purpose is to sharpen already existing imaging skills or to recapture those natural abilities suppressed, visualization exercises must be structured and consciously used.

There are three types of visualization which can be used individually or in combination:

1. open-screen (receptive) visualization: During this imagery open-ended questions are asked or a theme is established. Pictures are allowed to emerge spontaneously. This is good to use to evoke forgotten events or information and to produce answers to current problems or issues.

2. programmed visualization: The teacher or student "feeds in" exact information to produce the picture desired and the students visualize as they want it to be. This technique is particularly good to use when the individual wants to relieve pain, affect his/her relationship with another, win a game, get a job, improve test scores, etc.
3. guided imagery: This follows a set of directions or a scenario in which the imagination is sparked by a verbal trip, including the scene, mood, characters, events, and other details necessary for comprehension. This is particularly effective when attempting to create a mind-set for a new lesson. Although it can be used anywhere in teaching and learning, it is particularly appropriate when used as an advanced organizer.

Ideally, once students have facility with these three types of of visualization they will be able to create at will the fourth type in which they become the writer, producer, star, and camera of an external authority figure or director. In this way students can use imagery in backward and forward inferencing when doing homework, in extra-curricular activities, and in problem solving inside and outside the classroom.

Students can be introduced in steps to mental imagery over a period of several weeks. Initial steps can be as simple as discussing a concrete vocabulary word or key concept and then imagining it in the mind's eye. To bring it to the totally conscious mind, the student can then illustrate the concept through movement, drawing, or writing.

From this the student can be guided to visualize abstract concepts which occurred in the lesson such as courage, love, democracy, or friendship. When eliciting these responses from students, teachers should encourage them to involve as many senses as possible as they evoke the image--mentally smelling, touching, seeing, hearing, feeling, and tasting.

To further enhance the visualization students should be guided to see themselves actively involved with the concept, to be a character in this brief episode. The vocabulary word or concept should be visualized in a particular setting so that the student can see, hear, smell, and taste all of the details of the imaginary surroundings. These should be allowed to happen and not be forced--teachers cannot tell students what to see, but building necessary background prior to the exercise will certainly help create more vivid detail.

Mental imagery in whatever form speaks to the subconscious mind. Since birth students have been storing rich images and associations learned through their senses. It is believed that everything that has ever been experienced by an individual is stored in his or her subconscious. When students are in a relaxed environment and their senses are stimulated, this vast storehouse of conceptual knowledge is activated. If the knowledge is stored, so is the understanding of that knowledge. Teachers can access the data already stored, observe to see where the holes in the students' conceptual framework are for filling in so that new information can be built on an accurate and solid foundation, and images that are improperly stored can be reprogrammed.

It is important to use imaging in a guided and constructive way. Images have corresponding physical correlates which can and will be manifested in reality. When analytical discussion and multisensory activities follow imagery exercises, there will be rich benefits.

Since visualization is an imaginative response and when used with appropriate follow-up, it can be a powerful way to integrate the conscious and subconscious mind. The mind, both conscious and subconscious, operates simultaneously as it senses, feels, thinks, and intuits. When guided imagery is used with analytical follow-up the imagination is put to use in a controlled way. In contrast is the sporadic wandering of daydreams in everyday life. If learning is to be affected in a positive way, there needs to be control. This can come from the teacher in the form of guided imagery and discussion and/or the students can be taught to control and direct their own movies-in-the-mind.

Once teachers have modeled guided imagery experiences, students can be encouraged to develop their own as they read and listen throughout the day. This will increase their focusing and attention and as a result their comprehension will be impacted positively as they pursue goal-oriented visualization.

There are many uses for imagery in the classroom:

1. When used in the introduction to a lesson, imagery can reduce counter-productive, inhibiting blocks that cause anxiety.
2. Imagery facilitates problem solving, decision making, and creativity.
3. It can be used to create positive attitudes and feelings.
4. Imagery increases motivation for learning.
5. Imagery can provide an excellent rehearsal technique for physical and mental activity.
6. Imagery serves as a "warm up" activity prior to class discussion, brainstorming, creative writing and

Teachers can move from key concepts to brief episodes in a story by reading the episode to the students while the students' eyes are closed. Specific directions to stimulate this will help prior to reading. From this, a student should be encouraged to visualize in his mind's eye what he is reading about or listening to. Through this simultaneous exercise, pupils will be connecting their own experiences with that of the theme or content of the selection (hooking the old to the new), assimilating and integrating new information.

Several suggestions should be followed to make this practice more effective.

a. Guided imagery should be preceded by a relaxation technique (e.g., deep breathing).
b. The teacher should speak slowly and smoothly in an easy manner.
c. There should be a beginning point, and after the teacher has led students through a sequence of events, she/he should always bring them back to the starting point to bring closure so that attention can be focused on what is to come next. (There will be an occasional exception to this. For example, if the teacher wanted to have students begin a creative writing assignment while still "on their trip", then the writing assignment would bring closure.)
d. Students should be encouraged not only to evoke pictures in the mind but to involve other imaginary senses such as auditory, motor, gustatory, olfactory, and tactile.
e. When describing a series of events, the teacher should stop periodically to ask questions that the pupils answer in their visualization (not orally at this point). During the imagery, there will be occasional use of evocative technique which focus awareness in-depth for a specific purpose. Images are focused in non-verbal answer to question or comments. (what color is it? Put in all the physical details. How do you feel about this? What are you doing? What do you see in the distance? What will happen next?)
f. Students should put themselves in the imagery as a character or observer.
g. Music played quietly in the background (Classical or Baroque selections which are unobtrusive) can facilitate the quality of the visualization. Music not only more actively engages processing in the right hemisphere, but relaxes students. When there is alert relaxation, information buried in the subconscious is more accessible.

When the subconscious is allowed to express itself through visualization and when this visualization is guided or controlled so that it correlates with a specified curriculum, there are numerous advantages; excess psychic energy is released in a constructive way; increased awareness and understanding is brought to the content or skills being studied; suppressed and underdeveloped creative abilities are unleashed and sharpened and inner increased awareness leading to less stress; and a more joyful learning attuted is produced.

Immediate results are increased comprehension and improved oral and written language facility as evidenced in follow-up analytical discussions. Focusing and concentration skills are improved and since all of these advantages foster a sense of success and well being, more positive self-concepts will emerge.

Free Drawing

This is a technuque which provides many of the same benefits as guided imagery and can be used for the same purposes. It is an effective way to express feelings, release suppressed psychic energy, and express ideas visually.

The approach to free drawing can be directed or non-directed. If non-directed, the participant simply lets it happen spontaneously on paper by using the drawing utensils in a playful way. Using free drasing for relaxation or prior to a learning session can be a channel for releasing pent up or negative energy and help the mind to be more receptive to learning.

Directing the free drawing can be productive for the conscious and subconscious mind. Used to follow-up a guided imagery experience, it can reinforce learning and provide insights. Students should not be concerned about reproducing the experience precisely. Their sensory experiences and feelings are what they should capture in color and shapes. This is not an art lesson and precision should be de-emphasized, simply as a medium for visually expressing ideas and feelings in a non-threatening way.

Background music (especially Romantic, Classical, or Baroque selections) will enhance the spontaniety of the activity. Once completed, students should have an opportunity to discuss their products. They can do this in large groups, small groups, or with partners. Their sharing should be guided. Responses can include discussion about color, mood, movement, symbolization, and message. They should be encouraged to share in their way.

Visuals to Create Mood

Visuals can create a positive climate and environment for learning. Inexpensive prints are available to create a restful non-clutterd feeling for alert relaxation (e.g. a pastoral scene). Many students who are easily distracted through internal or external stimulation can find it calming to gaze at a picture for a few moments. Unobtrusive Classical or Baroque music can enhance this. Some will lose themselves in the tranquility of the picture others will extend the subject in the picture and use their own visualization techniques through an imaginary trip to enter our "special place". Pictures of a quiet ocean, a peaceful valley, a cool woodland area, or a tranquil mountain top are provided so students can acquire a relaxed alert state which makes them more receptive for new information the teacher presents or more open to receiving information during a study period.

Visuals as Organizers for Learning

Pictures (published prints, magazine and text pictures) can also enhance learning of new material. They can serve as visual organizers. They not only can help create a mood for general suggestibility to learning, but they can create a specific mood necessary for adequate comprehension of unfamiliar material. Since all seeing learners are somewhat visual and forty percent of the population learns best through their visual modality it is most productive if all key concepts in a lesson are presented visually both verbally and non-verbally. This can be accomplished through direct instruction or through indirect means in which visual learning takes place in the periphery.

There are numerous ways to effectively utilize pictures in a direct way to reinforce content material. One scenario would be as follows: A story, article, or book is to be read which relates to a unit being studied. Attached to a poster, easel, or bulletin board are displayed pictures relating to the major concepts to be presented in the selection; (these can be presented also through slides, transparencies or film; however, the pictures have the advantage that they require no equiptment and they can stay up longer for ready reference as the development of the text progresses.)

Graphic Organizers are a holistic, organized, visual representation of information displayed in a framework showing relationships among ideas. Since thinking occurs in one's head, it is difficult to discern how or what a student or teacher is thinking (if thinking is occurring and how one is processing). Graphic organizers such as mind maps, enable one to "see" thinking. They help teachers and students

to determine relationships among facts and concepts
to tie new information to pre-existing
to represent abstract ideas in a concrete form
to more efficiently store and access information
to aid in organizing and elaborating on thoughts

Peripheral learning, which occurs automatically and without attention of the learner, is another area through which literacy can impact in a positive way. There seems never to be enough time during a class period to meet the individual needs of students. Using visuals around the room in the form of posters, pictures, graphic organizers, and slogan cards can give students the extra reinforcement they need.

To view this concept in more detail, consider for example how peripheral visuals can keep recall constantly high through spaced review. After a learning session, there is a rise in the processing and retention of information for up to ten minutes. After that, unless there is intervention through review, it is estimated that up to eighty percent of the new information is lost within the first twenty-four hours. In order to keep retention high spaced review should occur periodically as follows:

1st review- after ten minutes
2nd review--twenty-four hours
3rd review- one week
4th review- one month
5th review- six months

It is the rare teacher or student who is disciplined or self-motivated enough to review material periodically after it has already been tested.

If the teacher and class developed a large mind map on a test chapter or unit and then displayed the map on the wall for several weeks after the test, students would continue to see the facts and concepts in an interrelated way even though the teacher had progressed to a new area of study. Their "paraconscious" minds would still process the peripheral information as long as it remained visible.

Teachers using an individualized spelling approach in which each student had a copy of his or her spelling words for the week taped to the top of his or her desk, reported much improved spelling test grades at the end of the week because the students unconsciously were exposed to the words numerous times each day.

As the teacher introduces the lesson, a series of picture reading steps could be used to include high-level thinking skill and to serve as an advanced organizer for the lesson:

a. identify main idea
b. note specific detail
c. draw inferences
d. make predictions
e. extend beyond the picture
f. relating to our personal experience

After a cooperative discussion of the pictures, the students could read the selection and refer to the pictures during the reading as they develop the content. After reading, the pictures could be used as a stimulus for visualization, writing, or dramatization. The pictures could be used in a follow-up discussion which would be more enriched than the prereading one, because the students have additional information through reading.

Schools will create a better balance in the educaitonl setting when students are permitted to manipulate pictures in order to understand sequence, to draw their vocabulary words as well as write about them in order to understand and reinforce meaning, to use a variety of visual metaphors to demonstrate assimilation of new concepts gained through research, and to use a combination of visual/verbal strategies as they integrate new information with pre-existing schema. Since Western culture seeks to address the needs of all socio-economic and ability levels, and within these levels students bring a wide range of verbal and non-verbal competencies, a more democratic society is created in schools when there is a better balance between visual/verbal language.

Language-based instruction across the curriculum has been emphasized for years. A more total language-based model will evolve when visual language is deliberately incorporated in the curriculum and this will provide **their ability** to read visuals and to create visual lanugage, they will be combining visual/**verbal language for** intentional communication. This will automatically improve verbal language so highly valued in America. Visual literacy is even more vital as students of today will beliving in a more global society thatn previous generations, and visual literacy is an international language, enhancing the ability to communicate across cultures more effectively.

The Effects of Cognitive Style and a Supplantation Technique on a Picture Detail Recognition Task

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Instructional research has developed an empirical base which integrates a visual medium's unique attributes with the psychological requirements of specific learning tasks. This type research is referred to as aptitude-treatment interaction and proposes that alternative uses of media be devised to capitalize or match the particular learning styles of the learner. Ausburn and Ausburn (1978) argue that when a learner's manner of transforming stimuli prevents the completion of a learning task, some way must be found to overcome this difficulty. Moreover, they argue that this is the primacy of cognitive style as a research variable: it deals with learner modes and abilities in information processing, and as such this research is based upon discrepancies between how a student processes information compared to how the student transforms stimuli. When these learner discrepancies are evident, a technique (e.g., supplantation) to overcome them must be found. In the same vein, Salomon (1972) suggests research be designed to study the instructional conditions where this technique is applied and where it is withheld.

An important implication of cognitive style concerns the way a learner perceives what is taught. If the individual's cognitive style hinders the processing of stimuli for one reason or another, then the task may not be learned. One way around this, of course, is to provide some assistance to the learner. Ausburn and Ausburn (1977) have termed this assistance "supplantation" because the learning task is broken down into its component parts and analyzed in terms of the individual's cognitive style. Wherever the breakdown in communication is found to be, this are is then supplanted through some means, e.g., zoom shot, which would allow the learner to complete the task.

Cognitive style can be defined as the method an individual perceives stimuli and processes the raw data. This is a very individual task and differs for each person. While 12 cognitive styles have been documented through research (Corvey & Ehrhardt, 1978), for purpose of tis study only the field-independent/field-dependent cognitive style is considered. The field-dependent cognitive style is a person's tendency to to see stimuli as holistic or global while the field-independent cognitive style is the tendency to experience items as discrete from their background (Krogan, 1971). Field-independent individuals tend to extract a figure from its ground or background while field-dependent individuals tend to see figures only in relation to their background (Witkin & Goodenough, 1980). One style is not better than the other and scores on tests developed to measure cognitive stule tend to fall on a continuum. Those on one side of the continuum are said to be more of one style than the other. If a person is easily able to discriminate simple figures in complex designs, the person is classified as field-independent. Such persons are believed to have analytical perceptions because they can easily extract simple figures from irrelevant contexts. People who have difficulty doing this are classified as field-dependent. These individuals are believed to perceive globally, attending to the relationships between lines rather than the outline of the simple figure (Corvey & Ehrhardt, 1978).

Furthermore, Witkin, Moore, Goodenough & Cox (1979) argue that television presentations are relevant to the field-independent and dependent cognitive styles. Research on television formats versus written formats shows that field-dependent individuals exhibit better achievement with television since structure is readily available (Kogan, 1971). Television formats include the camera shot, the camera shot selection, and videotaped edits which can change the visual message. For example, a television frame showing a close-up and a wide view of the same scene directs the viewer to two different messages. In the close-up the intent may be to stress the detail, while in the wide view, the "panorama" of the scene may be the message intended for the viewer (Salomon, 1974a). The perception of a televised image is influenced by the viewer's ability to encode and decode the visual field and is directly affected by the cognitive style. Consequently, a field-dependent person will be unable to select specific parts of a visual field and will need some accommodation to select the proper information. Salomon (1974a) argues that the employment of a camera shot affects the student's imagery and inference making ability. Salomon (1974b) also notes that television formats have many visuall cues which must be encoded and decoded. Because field-dependent persons may not be able to sort out a visual field, Salomon argues, the camera shot is critical. Consequently, researchers have hypothesized that field-dependent individuals will benefit from the use of the television shot as a supplantation device.

In one of the few research studies to date to employ the zoom technique, Salomon (1974b) used the television camera shot as an approach to improving cue attendance ability. Salomon reported that the results of this experiment lend tentative support--that "zooming in" and "zooming out" are learnable. As a supplantation device, the zoom technique proved efficacious in improving cue attendance posttest scores. Moreover, Witkin, et al. (1977) and Gross (1974) have argued, as stated previously, that the television camera shot properly employed may aid field-dependent learners. It is this technique of supplantation which is to be investigated in the present study.

Specifically, the purpose of the study was to determine the effects of a particular supplantation technique (a zoom versus no-zoom treatment) an a sample of students classified as field-independent or field-dependent learners in the teaching of a picture detail recognition task by means of a television presentation. The zoom technique was used to determine if field-dependent learners' inherent decreased ability to focus on items in a visual field might be aided or supplanted by its use. The television camera zoomed in on a detail in a picture and faded to black. The zoom technique was hypothesized to provide the focus which field-dependent learners by definition might not provide themselves. Another aspect of the study was to determine if the zoom technique could be modeled. That is, could this technique be learned and could the observation process be transferred to another learning task? The study also considered whether the posttest scores on a picture detail recognition task were affected by the interaction of the presentation mode (zoom or no-zoom) and cognitive style characteristics.

SUBJECTS

Participants in this study were 119 students in Composition classes at Bluefield State College (BSC) located in Bluefield, WV. Eight English composition class students were selected because the students were enrolled in all curricula at BSC assured a representative cross section of the student population (1700 full-time students).

DEVELOPMENT OF THE INSTRUMENT

The effectiveness of the zoom or no-zoom treatments was investigated by means of specially developed video tapes of the visual stimuli. For these treatments, three* Picasso paintings were selected: "Interior with a Girl Drawing," "Mandolin and Guitar," and "Bullfight" (Duncan, 1968). Picasso's works were chosen for the experiment because of the extreme amount of visual detail available which would aid in selecting similar yet different details in sufficient number for the criterion measure. Two 5-minute treatment videotapes were developed. Color slides of each of the three above noted paintings were projected separately on a screen and were videotaped by means of a color video camera.

In videotape A (the zoom treatment), the camera zoomed in on 20 details of the first two paintings in a random sequence, for example, a facial expression or a hand, and faded to black. Twenty close-up shots of each of the first two paintings were randomly selected, to provide an adequate number of detail shots for subjects to remember, thus increasing the likelihood of an adequate range of scores on the recognition tests. The third painting was videotaped as a wide angle view of the picture without using the zoom technique. In the first two trials of the zoom treatment, the subjects were exposed to the zooming effect; however, the third trial was used to determine if the zoom condition could be modeled. In both cases the detail was zoomed in on, held for 5 seconds, and faded to black, making videotape A (the zoom treatment) 5 minutes long. In each of the zoom shots, the distance of the camera from the projected image and the time of the zoom itself remained constant as did the size of the image.

In videotape B (the no-zoom treatment), each of the Picasso paintings was shown in full on the television screen for 100 seconds and faded to black, making the length of the second tape 5 minutes. Tne pictures in the no-zoom treatment were the same as in the zoom treatment and shown in the same order. The only difference between the two treatment tapes was that the first treatment tape (A) employed the zoom technique, while the second treatment tape (B) employed the no-zoom technique.

The dependent measures consisted of three 10 item multiple-choice (five choices) posttests. The object of the dependent measure was to test for recognition of details in the picture seen in the zoom shots when shown with details from pictures not seen. Thus, four details from additional Picasso paintings along with a single detail from the stimulus picture were videotaped together, thereby allowing the students to see them simultaneously on the television screen. The students were then to select the one detail seen previously in the stimulus picture. This procedure would be repeated for all three pictures (10 items each). In each case, the test containing five details would be shown, held for 10 seconds, and would fade to black. Students would have 10 seconds to mark the answer sheet before proceeding to the next test item. The three posttests were edited into both treatment videotapes in order that picture 1 would be followed by posttest 1, picture 2 followed by posttest 2, etc.

This instrument was designed to conform to similar research by Salomon utilizing the zoom technique (Salomon, 1972, 1974b). The crux of this study was to determine whether field-dependent subjects could be aided in the recall of a learning task through the use of the zoom technique as a supplantation device. One treatment (zoom) provided the supplantation device, and another treatment presented the learning task without a supplantation device, e.g., the control group. In each treatment, but especially in the zoom treatment, the time each slide was shown was restricted in order to overcome the problems of many visual studies which indicated a 90 percent recall of slides shown in a series (Standing, Conezio, & Haber, 1970).

RESEARCH PROCEDURES

Students were classified as field-independent or field-independent by means of the Group Embedded Figures Test (GEFT) (Witkin, Oltman, Raskin, & Karp, 1971). Those scoring 10 or above were classified as field-independent (n=51) and those scoring 10 or below were classified a field-dependent (n=68) (Baron, 1969). For the 119 subjects taking the 18-item test, the mean score was 8.77 and the standard deviation was 4.96.

Each class viewed the individual treatment tapes on four 21" color television monitors. Students were seated in rows of three, two per television monitor. After viewing each of the three Picasso pictures, the associated posttest--a ten-item multiple-choice exam was administered to each student. Of the eight class sections, four randomly selected sections viewed the zoom version while the remaining four sections viewed the no-zoom version. All eight sections viewed the same picture details which formed the posttests.

RESULTS

A 2x2x3 factorial analysis of variance was used to analyze the data with the last factor (trials) representing the repeated measure. (See earlier note.) The repeated measures design allowed the study of the three trials of the treatment effects. Since differences across subjects are often quite large relative to differences in treatment effects being evaluated, the repeated measures design offers increased statistical power over the standard factorial analysis of variance. Another advantage was the economy of subjects (Winer, 1971).

A significance level of .05 was set for all tests of the null hypothesis. Table 1 provides a summary of mean scores by independent variables across all three posttest trials. Table 2 contains the summary of the analysis of variance.

The first research question tested was whether field-dependent or independent cognitive style would affect the student's ability to recognize picture details presented in the television format. Neither or the main effects of cognitive style F(1,115)=0.12, p<.05 nor the F-ratio for presentation mode (zoom, no-zoom) F(1,115)=3.54, p<.05 were significant.

However, inspection of the zoom and no-zoom treatments means revealed that those students tested under the zoom treatment (x=5.99) did score higher on the recall posttests than did students under the no-zoom treatment condition (x=5.63). No significant interaction took place between cognitive style and presentation mode (zoom, no-zoom), F(1,115)=.009, p<.05 (see Table 2).

Under the zoom treatment, the field-dependent individuals (x=6.04) scored higher than the field-independent individuals (x=5.95), whereas under the zoom condition, the field-independent individuals (x=5.77) scored higher than field-dependent individuals (x=5.48) across all three learning trials. Although, these results in the hypothesized pattern, the interaction effect was not significant and thus the results must be considered a chance outcome.

A major concern of this study was to determine the influence of the zoom/no-zoom technique on field-dependent individuals. While there was no significant interaction between presentation model and cognitive style, a secondary analysis was conducted using only the field-dependent individuals' scores by presentation mode (zoom/no-zoom treatments). The raw scores of each student on the three posttests in each presentation mode were combined. A one-way analysis of variance was generated. The results indicate that there was no significant difference, [F(1,66)=1.12, p<.05], due to either treatment effect on field-dependent subjects.

One of the purposes of using the repeated measures design was to study picture detail recognition across three learning trials as a result of the treatment effects. In the repeated measures design, there were three sets of posttest scores (10 items each) for each subject and the order in which they appeared constituted an independent variable. While the order of the first two trials was not of interest, the third trial was used to test the efficacy of the modeling effect. Thus, the third independent variable of the study was learning trials. The analysis of variance showed that the F-ratio for learning trials. The analysis of variance showed that the F-ratio for learning trials was significant, F(2,345)=26.6, p<.001. This indicated that the average number of correct pictorial details recognized differed in the three blocks of trials. Inspection of the table of means indicated an increasing number of correct recognition scores between Trial 1 and Trial 3 for both treatment groups. There was no significant interaction between trials and treatment condition, F(3,345)=1.44, p<.05 (see Table 2).

DISCUSSION

One of the purpose of this study was to determine whether field-dependent subjects could improve picture detail recognition through the use of the zoom television shot which would serve as a supplantation device. A previous study which discussed the use of supplantation conducted by Salomon and Cohen (1977), found that zooming in from a long shot to a close-up produced higher recall scores among students significantly superior to a close-up version (the whole picture was shown and immediately cut to a detail). Salomon (1974b) found that the zoom technique group exhibited higher posttest scores when compared to a whole detail group but scored no higher than the whole picture group. However, the results of this study did not support these earlier findings of Salomon and Cohen (1977) or of Salomon (1974b).

The analysis of variance in this study revealed no significant mean differences for either of the main effects of substantive interest (cognitive style and treatment condition) nor for the interaction between these two factors. Even though the results were not significant, the mean differences varied as hypothesized. A secondary analysis comparing only field-dependent subjects under treatment conditions (zoom/no-zoom treatment) reinforced this non-significant result.

Another aspect of this study was to determine if the zoom technique could be modeled. Could this technique be internalized and this observation process be transferred to a similar detail recognition task? While both treatment group mean scores did improve significantly from the first to the third trial, a simple main effects test using the zoom and no-zoom treatments was conducted on both third trial scores. No significant difference in trail means was found ($F(1,460)=2.19$, $p<.05$). Thus, it appears that the significance in trial means was as much an increasing familiarity of the test rather than the effectiveness of either treatment. Therefore, the hypothesis that the zoom treatment could be able to be modeled was not proven in this experiment.

The results using this particular zoom technique did not verify the Ausburn and Ausburn (1977) supplantation theory nor did the results support Salomon's (1974b) findings. Although the results of this study using a zoom treatment did not supoort prior research findings, other supplantation techniques still appear to be a variable approach to accommodate field dependent individuals and as such, additional work in the area is recommended.

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Table 1. Tables of Means

	Treatment								
	Zoom				No-Zoom				
Cognitive Style	T_1	T_2	T_3	X	T_1	T_2	T_3	X	M
Field Dependent	5.35 (1.53)	5.95 1.85)	6.82 (1.62)	6.04 (1.55)	5.17 (1.61)	5.13 (1.77)	6.14 (1.81)	5.48 (1.73)	5.76 (1.74)
	n=39				n=29				
Field Independent	5.52 (1.12)	5.76 (1.55)	6.59 (1.38)	5.95 (1.35)	5.50 (1.41)	5.18 (1.30)	6.64 (1.73)	5.77 (1.48)	5.86 (1.42)
	n=29				n=22				
Total	5.42	5.86	6.72	5.99 (1.45)	5.31	5.15	6.35	5.60	5.68 (1.60)
	n=68				n=51			X	5.81 (1.53)

*T - trial
( ) SD

N=119

Table 2. Summary of Analysis of Variance

Source of Variation	SS	df	MS	F
Between subjects				
A (zoom/no-zoom treatment	13.78	1	13.78	3.54
B (cognitive style)	0.45	1	0.45	.12
A*B	3.09	1	3.09	.009
Subjects within groups error (between)	447.25	115	3.89	
Within subjects				
C (trials)	96.71	2	48.35	26.57*
A*C	5.25	2	2.63	1.44
B*C	1.53	2	0.77	0.42
A*B*C	1.33	2	0.67	0.37
C X subjects within groups error (within)	417.85	230	1.82	

p<.0001

Designing Instructional Materials: Some Guidelines

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The process of designing effective instructional materials depends first on careful planning which is a complex procedure that involves:

- Analyzing the specific educational or training needs
- Knowing the specific physical, socio-economic, educational, and psychological characteristics of your audience
- Determining the psychomotor, cognitive, and affective objectives that are to be met
- Delineating the content to be communicated
- Deciding the most appropriate teaching and learning strategies
- Evaluating each step of the process

Based on careful planning instructional materials can be designed following principles that fall into five major categories:

- General Design
- Instructional Design
- Visual Design
- Text Design
- Audio Design

There are a number of principles of design, or guidelines, that can be suggested in each of these five categories.

GENERAL DESIGN PRINCIPLES

Structural appeal

Clarity

- In order to present information so that it is clear to the learner you must use logical organization, divide complex information into small units, and present crucial information at the beginning and at the end of a presentation.
- Provide a clear orientation, using introductions and summaries, and be sure to show a visual overview before focusing in on visual details.

Emphasis

- Use visual and verbal cues plus repetition to emphasize key elements of your presentation.

Pacing

- Use pacing that considers the learner, the subject matter, and the desired response.

Visual/verbal Reinforcement

- Be certain the verbal visual elements are reinforcing each other and are not communicating different messages.

Personal appeal

- Be certain your audience understands the positive consequences of the learning.
- Use examples that are familiar to the audience.
- Use a learner's viewpoint: This is particularly important in "how to" materials.
- Do not exceed the perceptual capacity of the learner.
- Use questions - where appropriate - to keep your audience involved.

INSTRUCTIONAL DESIGN PRINCIPLES

Attention

Attract

- Use variations in size, color, brightness, and shape or employ novel visuals to attract attention.

Hold

- To hold attention, be certain that the material presented is meaningful to the learners.
- Consider the complexity of visual materials: Very simple or very complex visuals do not hold attention as well as moderately complex visuals.

Perception

- Perception is relative, so use size indicators and consider what is seen simultaneously and sequentially.

- Perception is selective, so limit the amount of information presented. Use only pertinent information, and visual and verbal cues to focus attention on key points.
- Perception is organized, so arrange material in keeping with the subject matter. Use arrows, numbers, or other cues to direct the learner's perceptions.
- Perception is influenced by expectations, so use appropriate formats and cues such as headings or to aid learner in knowing what to expect. High quality graphics and photography can increase the expectation that material being presented is important.

Memory

- Memory is facilitated when material is meaningful to the learner.
- Memory is aided by associating unknown items with known items.
- Repetition facilitates remembering.
- Memory depends on consequences.
- Using concurrent modes; i.e., words and pictures, promotes recall.
- Objects and pictures of objects are remembered better than just their names.
- Organizers can provide a structure that aids memory.
- Questions can focus attention and facilitate recall.

Concept learning

- Conceptual learning can be increased by using a variety of examples and non-examples.
- Use realistic pictures to show what things look like. Use simplified pictures to eliminate information.
- Combine names with pictures to increase conceptual learning.
- Put criterial items in list form; do not embed them in a sentence.

Attitude change

- Attractive and credible presenters contribute to positive attitude change.
- To promote attitudinal change be sure to organize the message carefully: If the audience has little interest in the topic, present conclusions first. If the audience is interested, but negative, present arguments first, followed by conclusions. Present various points of view. If the audience is not familiar with the arguments, then present favorable points first, but if they are familiar, then present con arguments first, and point out weaknesses before presenting the positive points of view. Clearly state the conclusions you want the audience to reach.
- Materials should be accurate, carefully designed, and of good quality to promote changes in attitude.
- Choose a medium that is considered credible by your audience.

VISUAL DESIGN PRINCIPLES

Media considerations

- When planning printed materials. consider how, where, and by whom they will be e.g., materials for poor readers must be designed differently than those for good readers.
- Consider the type of reproduction. Fine detail can be lost in printing of poor quality.
- When planning projected materials consider the ambient light under which these materials will be shown.

Pictures

- Carefully choose the elements that are to be included in a picture. Consider their relevance, simplicity, and harmony.
- When organizing the elements of a picture consider the following aspects:
    - viewpoint
    - visual pattern
    - balance
    - emphasis
    - unity
    - variety
- When making photographs the treatment of the elements is important. Consider:
    - lighting
    - perspective
    - the instant a picture is taken
    - focus and sharpness
    - value-the lightness or darkness of the picture
- When producing graphic materials, consider:
    - the graphic style
    - perspective
    - the technical quality

Graphs & diagrams

- Line graphs are particularly useful in showing trends over a period of time and relationships between two or more factors.
- Bar graphs are effective for comparing magnitude or size.
- Pie charts (or circle graphs) are good for showing the relationship between a whole and its parts.
- Simplicity is particularly important in graphs and diagrams for instructional purposes.
- Numeric scales and data points on graphs should be carefully chosen to avoid confusion, misinformation, or ambiguity.
- Symbols employed in graphs and diagrams should not be arbitrarily selected

and should be familiar to all persons in the audience.

Words-projected

- Limit the number of points to be made in a visual employing words.
- Use key words, not sentences.
- The number of words in a visual should be no more than 15-20.
- List items in columns.
- For good legibility, lettering should be no smaller than 1/24th the short dimension of the artwork.
- Use a simple serif or sans serif style of lettering.
- Remember, medium weight lettering is generally best.
- When there are several lines of type use a mixture of upper and lower case letters, as appropriate and grammatically correct, to improve legibility.
- Consider the mood of the type face and how it relates to the subject matter.
- Leave adequate space between letters, words, and lines.
- Maintain a moderate to high contrast between the lettering and its background.

Words-print

- Line length should fit a typical group of words. Optimal line length is 39 characters and 25 to 50 is the acceptable range.
- 55 lines has been found to be an ideal page length.
- Right justification is not necessary; it increases cost and studies show it reduces reading speed.
- A variety of page organizations can be used, but within one document a consistent organization should be followed.
- All illustrations should be closely related to the text.
- When explaining a process use one illustration per step.
- Use a list or outline of the content to help learners in organizing information.
- Use bullets, numbers or white space to separate and attention on key items.
- The type size range for good readability is 9 to 12 points. Use the larger sizes if the x height is small.
- Even though there is a slight preference for serif typefaces any simple serif or sans serif typeface can be used, but avoid condensed typefaces.
- As with projected visuals, do not use lines of all capital letters, but use a mixture of upper and lower case letters.
- A medium stroke width is preferred to a very light or very heavy stroke width.

- Consider spacing between words and lines. Adequate space between lines increases readability.
- Maintain a high contrast between type and the background. However, avoid white or light letters on a dark background.

Color

- Consider the context in which a color will be viewed- what colors are to be seen simultaneously or sequentially?
- Use the spectral extremes, red and blue, to attract attention.
- When acuity is important, employ colors in the middle of the spectrum.
- For optimum legibility maintain a high brightness contrast between an image and its background.
- Photographing colored objects demands the use of an appropriate film and judicious lighting to assure good color rendition.
- Saturated cool or warm colors are appropriate for small children. Less saturated cool colors may be more suitable for adults.
- Consider the meaning of colors as they relate to your audience.
- To attract attention on use extremes of value or chroma.
- To achieve harmony use familiar color schemes, organize carefully, and employ colors with similar attributes.
- Research shows that color creates interest and that people prefer color to black and white.
- Easily named colors aid memory more than colors that have complex names.
- Use color to provide structure, to emphasize relevant cues, to differentiate central from peripheral information, and to make distinctions between elements of a visual.

TEXT DESIGN PRINCIPLES

Content

- When developing the content for textual materials, consider the audience, the information to be presented, and the way the audience will process the information.
- Include all essential content and eliminate extraneous information.
- Link new material with what the learners already know.

Writing style

- Use an appropriate reading and vocabulary level.
- Short consise statements with concrete, familiar words will significantly aid your readers.

- Use active language and visual and verbal analogies.
- Use diagrams or algorithms where appropriate. These will not only add interest, but will greatly assist the reader in learning the material.

AUDIO DESIGN PRINCIPLES

Functions

- Use the audio track to identify or describe visual elements, but, avoid excessive redundancy.
- The audio track can add information that cannot be expressed visually, and it can be employed to reinforce visual messages. Be certain, however, that the two modes (audio and visual) do not convey different meanings.
- Use verbal cues to organize the viewer's visual perceptions.
- The design of the audio track should optimize visual-verbal flow.

Structure

- Maintain a logical organization Use organizers such as "step 1, step 2 etc." or use preliminary statements that indicate what is to follow.
- Maintain simplicity by breaking complex ideas into simple ones, avoiding extraneous information, unwanted sounds, or misplaced pauses.
- Be certain the narrative style is appropriate to your listeners.
- Start with information that is motivational so the benefits of paying attention will be self-evident.
- Create variety by changing the volume, pace, or voice about every 20 to 30 seconds depending on the audience and the objectives.
- Involve your audience with questions or pauses for discussion.
- Tell the learners what you are going to tell them, tell them again, then tell them what you told them.

The recording

- Write for listening, not reading.
- Avoid complex sentences and use familiar words.
- Employ short phrases that will give the listener time to comprehend and synthesize the material.
- An informal conversational style is best.
- Avoid any wording that would cause the narrator to falter.
- Be sure to choose a credible narrator and one who is appropriate to the audience.
- Two or more voices add variety and can increase attention and interest.

- The delivery rate must be suitable to the audience and the subject matter.
- Be sure the narrator uses correct pronunciation and emphasis.
- Choose suitable music.
- Avoid any musical score that might compete with the narration.
- Use sound effects to create realism and to add interest and emphasis. Be certain they are realistic and that they are employed judiciously.

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